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PHASE I AND PHASE II
REMEDIAL INVESTIGATION FINAL REPORT
RECTICON/ALLIED STEEL SITE
PARKER FORD, PENNSYLVANIA

Prepared by:

DAMES & MOORE

MARCH 29, 1993

APPENDIX W – RISK ASSESSMENT

The following is a summary of the comments to the Baseline Risk Assessment for the Recticon/Allied Steel Site. They have been arranged for internal use in order to answer the questions by subject. The comments in the left-hand column are summaries (arranged by subject), it should probably be replaced by the actual comment, in ascending numerical order.

Response to Comments on BLRA for Recticon/Allied Steel Site
(comments dated February 23, 1993)

Summarized Comments to BLRA	Dames & Moore Response
DATA EVALUATION	
Comment 44 Explain sample selection criteria regarding up- and downgradient soil samples (Page 3-4).	Samples were collected from the drainage ditches on the Recticon and Allied facilities. A limited number of samples were collected because of the relatively small area of the ditch. Only one sample was collected downgradient of the Recticon Facility because samples further downgradient would have received drainage from other sites and thus confound the determination of the source of any detected concentrations.
Comment 46 Report states non-detects were excluded when the Sample Quanitation Limit (SQL) > max detected concentration (Page 3-7). This approach may not be in accordance with RAGS. Additionally, this approach is of concern with regard to the potential impacts on the evaluation of vinyl chloride. See comment for more detail.	Even using one-half the detection limit, some of the detection limits, because of dilution, exceeded the maximum measured concentration. Moreover, lower detection limits and/or lower detected concentrations were reported for the same well.
Comment 47 Rephrase "...corrections for blank..." statement such that it does not implied that the concentrations were manipulated based on blanks. Page 3-10.	Text revised; "comparisons" substituted for "corrections".
Comment 48 As agreed by all parties, data from residential wells must be included as part of the site-specific background data. Likewise, the claim that upgradient sources may contribute to site contamination should be reviewed (accounting for all background data) and amended as required. Page 3-11.	We did not eliminate any chemicals based on background samples. All chemicals detected on-site were treated as if they originated from the site (Section 3.3.2).
Comment 49 Selection of exposure point concentration for TCE in the off-site receptor scenario is in question since the RME does not appear to have been used (TCE was detected at 1900 µg/L). Page 4-5 & Table 3-8. Discuss the groundwater data in terms of the pre- & post-filtration results. For the current off-site GW exposure (private wells), RA must use pre-filtration results to calculate arithmetic mean & 95% UCL; revise risk calcs as necessary. Page 4-5. See comment for details.	Comment addressed in Sections 4.4.3 and 6.3.2. The concentrations used for the current off-site resident are the maximum concentrations detected in 16 wells near the Site which are not treated. Six wells near the Site have carbon filter systems to remove contaminants. Chemical concentrations in treated water fall below detection limits. Since pre-filtered water is not used, exposure is not likely to occur with untreated water from the six wells with treatment systems (the risks associated with pre-filtered water would be comparable to the risks calculated for the future on-site resident scenario). Therefore, the concentrations from the untreated off-site wells provides a better estimate of actual current exposure.

Summarized Comments to BLRA	Dames & Moore Response
Comment 50 Augment discussion on selection of exposure point concentrations for future use scenario. This discussion should include listing of wells selected in evaluation. Page 4-22. See comment for specific requirements.	Since no single well contained the highest concentrations for all chemicals, all wells were considered to include all chemicals. The inclusion of all wells produces a lower average and a higher standard deviation, while the selection of only a few wells produces a higher average and a lower standard deviation. As a result of these off-setting influences, the 95% UCL for using all or a selected subset of wells is similar. Therefore, the effect on the risk estimates would be small.
ECOLOGICAL	
Comment 41 - Risk assessment cannot support conclusions made in executive summary page ES-2.	The need for additional copper and zinc samples is described in Section 7.0 & the Executive Summary.
Comment 42 - Habitat delineation may be improperly stated. Page 2-3. Ecological data are inadequate to evaluate site-related risks. Pages 2-3, 7-1 & 7-2. Copper & zinc concentrations in sediment (both up- & downgradient) are capable of causing biological effects. Data gaps for sensitive species exist. Discuss results of ecosystems investigation Sect. 4.9 of RI.	Additional text has been added to Sections 2.1.5.2 and 7.0 of the report providing data from the RI as well as discussion of data gaps. Figure C-1 illustrates the vegetation on the Site. Based on current sampling data, Cu & Zn levels may be capable of causing biological effects as indicated in Long & Morgan, 1990 (additional sediment sampling recommended, see Section 7.0).
GENERAL EDITING	
Comment 43 Groundwater remediation: Executive summary statement that use of a filtration systems, as part of the removal action, implies remediation of contaminated groundwater. See comment & page ES-3. Also on page ES-3, sentence hypothesizing the discounting of the groundwater pathway (promoting dermal contact of soil as dominant pathway) should be removed or revised.	Points acknowledged in the Executive Summary.
Comment 45 Change text. Soil samples are shown on Fig B-2 not B-4. Page 3-6.	Text corrected (Section 3.2.4).
Comment 51 Parameter "C" should be the RME, not the average. Page 4-23.	Text corrected; "average" changed to "representative" (Section 4.5).
Comment 52 Explanation of selection of exposure point concentrations differs between Tables 4-2 & 4-5. Correct as necessary.	Additional information placed in Table 4-5.
EXPOSURE PARAMETERS & HEALTH CRITERIA	
Comment 53 It is recommended that the following parameter values be revised. 1) Dermal contact with soil: SA for children to include head; M should be 1.0 not 0.5 (see '92 EPA dermal exposure guidance); ABS for metals, SVOAs & pesticides, and VOAs set at 1%, 10%, and 25%, respectively. (see ref. provided in comment) 2) Dermal contact (bathing): SA should be based on 95th percentile not 50th for total surface area.	1) "SA" for the future child resident was changed to include the head (see Table 4-7). "AF" changed to 1.0 mg/cm^2 per interim EPA guidance (EPA, 1992d. see Table 4-7). "ABS" values changed as noted except for PAHs which were not altered since existing data are more chemical specific than those suggested (see Table 4-7). Note that risk estimates in Section 6.0 changed as parameters were amended. 2) RAGS 6.6.1 & 6.6.2 states that 50th percentile values for SA be used for calculating the RME due to the strong correlation between SA & BW (which is also based on the 50th percentile).

Summarized Comments to BLRA	Dames & Moore Response
Comment 54 It is suggested that a Toxic Equivalency Factor (TEF) approach is used for carcinogenic PAHs per Clement 1991. Page 5-7.	Per phone conversation with Roy Smith, USEPA Region III-approved TEF approach incorporated accordingly. See Section 5.3 & health criteria Table 5-2. Note that risk estimates in Section 6.0 and Figure 6-1 changed as parameters were amended.
Comment 55 Update the SF for B[a]P accordingly (oral = 7.3 & inhalation = 6.1), incorporate into calculations along with above TEF. Table 5-1. See comment.	Changes made per comment. See health criteria Table 5-1. Note that risk estimates in Section 6.0 changed as parameters were amended.

APPENDIX W - DRAFT FINAL
BASELINE RISK ASSESSMENT FOR THE
RECTICON/ALLIED STEEL SITE
PARKER FORD, PENNSYLVANIA

APPENDIX W
BASELINE RISK ASSESSMENT FOR THE
RECTICON/ALLIED STEEL SITE
PARKER FORD, PENNSYLVANIA
FOR THE ROCKWELL INTERNATIONAL CORPORATION

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EXECUTIVE SUMMARY

A Baseline Risk Assessment was conducted for the Recticon/Allied Steel Superfund Site (the Site) in Parker Ford, Pennsylvania. The assessment was undertaken for submittal to the United States Environmental Protection Agency (USEPA) as part of the Remedial Investigation for the Site.

The Site covers an area of approximately 5 acres and consists of two separate facilities at the intersection of Route 724 and Wells Road:

- The Recticon facility, located at the western corner of the intersection, which formerly manufactured silicon wafers; and
- The Allied Steel facility, located at the eastern corner of the intersection. In the past, various solvents were used at the facility. These chemicals may have been discharged to soil where they eventually migrated to groundwater.

Sampling data from the Phase I Remedial Investigation/Feasibility Study (RI/FS) indicated the presence of chemicals, predominately volatile organic compounds (VOCs) in the two aquifers underlying the Site. To mitigate the potential for chemicals in groundwater, a Removal Action was initiated which required the monitoring and/or the installation of filtration systems in local water supply wells.

Several VOCs were detected during the soil vapor survey at the Site. Thirteen soil samples were collected from eight soil borings in the vicinity of elevated soil vapor concentrations. The thirteen soil samples were collected based on field screening to represent the highest measurable VOC readings. TCE and 1,2-dichloroethene (1,2-DCE) were not detected above the 5 μg/kg laboratory detection limit in nine of the soil samples. Three samples contained detectable levels of TCE at concentrations of 14 μg/kg or less, and 1,2-DCE was not detected in these samples. One subsurface sample (boring location R/A7 collected at 9 to 11 feet bgs), contained significant concentrations of TCE (1400 μg/kg) and 1,2-DCE (48 μg/kg); but a soil sample (R/A7A) collected approximately 15 feet away from R/A7, had no detectable level of TCE or 1,2-DCE. Though several compounds were found, the RI/FS noted that no concentrations of TCL or TAL parameters were detected above background concentrations in surface soil or surface water.

Four exposure scenarios were examined under current and future land use assumptions. Exposure of receptors to chemicals in potentially impacted media (surface soil, groundwater, and air) were examined under Reasonable Maximum Exposure assumptions. In addition, the potential for adverse effects to ecological receptors was also evaluated. The evaluation of the Site indicated the following:

Current Land Use

Onsite trespasser

- The hazard index (screening) did not exceed one.
- Total cancer risks were estimated at 3×10^{-7}.

Offsite resident

- The hazard index (screening) did not exceed one.
- Total cancer risks were estimated at 4×10^{-7}.

Future Land Use

Onsite worker

- The hazard index (screening) exceeded one; therefore, hazard quotients were summed by critical effect. Hazard indices based on critical effects did not exceed one.
- Total cancer risks were estimated at 3×10^{-4}.

Onsite resident

- The hazard index for one target organ (blood) exceeded one. One chemical, *cis*-1,2-dichloroethene (in groundwater) contributed the greatest amount. All other indices fell below one.
- Total cancer risks were estimated at 6×10^{-4}.

Ecological Effects

- Based on the nature of contamination on the Site and the location of wildlife habitat, organic chemicals do not appear to have the potential to produce adverse environmental effects. However, additional samples need to be collected to evaluate the potential for adverse effects associated with copper and zinc.

The cancer risks for each pathway are summarized in Table ES-1. The EPA notes as its benchmark to take action, a cancer risk estimate range of 1×10^{-6} to 1×10^{-4}. For the trespasser and offsite resident, carcinogenic risks fell below 1×10^{-6}. In the future scenarios, the groundwater pathways produced the greatest risks and accounted for over 90% of the total risks in both the onsite worker and onsite resident scenarios. The benchmark for non-carcinogens corresponds to a hazard index that exceeds one when the hazard quotients are summed by critical effect. Some of the uncertainties associated with risk assessment methodology and site-specific conditions are discussed in this document. However, several critical issues must be considered with the numerical estimates presented above:

- Ninety-five percent upper confidence limits of the arithmetic mean (95% UCL) of samples from the main plume area were used in the future groundwater risk estimates. As there is precedent in the area for the use of filtration systems (as part of the Removal Action), risks from the ingestion of groundwater may be dramatically mitigated by similar measures. However, it should be noted that the presence of filtration systems on individual wells does not constitute remediation of chemicals in groundwater and does not represent restoration of groundwater to its beneficial use.

- Following TCE, beryllium and arsenic produced the next highest risks in groundwater. Although no background samples are available, these compounds may be present as a result of naturally occurring levels and, therefore, may not represent site-related activities.

- Among the pathways not related to direct contact with groundwater, dermal contact with soil produces the greatest risk in both future scenarios. Polycyclic aromatic hydrocarbons (PAHs) were the dominant chemicals in the soil pathway risk estimates. These compounds may originate from anthropogenic, but not site-related, sources. The risk associated with background concentrations of PAHs is approximately half that of the risks associated with on-site concentrations.

These factors should be taken into account for the selection of remedial measures.

TABLE ES-1
SUMMARY OF CARCINOGENIC RISKS FOR THE
RECTICON/ALLIED STEEL SITE
PARKER FORD, PENNSYLVANIA

SCENARIO/PATHWAY	CANCER RISK ESTIMATE
CURRENT	
Trespasser	
Dermal Contact (Soil)	2.5×10^{-7}
Soil Ingestion	4.7×10^{-8}
Particulate Inhalation	1.0×10^{-10}
Vapor Inhalation (Outdoor)	4.7×10^{-11}
Total Risk:	3×10^{-7}
Offsite Resident	
Vapor Inhalation (Outdoor)	3.8×10^{-9}
Groundwater Ingestion	3.6×10^{-7}
Total Risk:	4×10^{-7}
FUTURE	
Onsite Worker	
Dermal Contact (Soil)	1.4×10^{-6}
Soil Ingestion	1.3×10^{-7}
Particulate Inhalation	4.3×10^{-10}
Vapor Inhalation (Outdoor)	1.9×10^{-10}
Vapor Inhalation (Indoor)	3.4×10^{-9}
Groundwater Ingestion	2.9×10^{-4}
Total Risk:	3×10^{-4}
Onsite Resident	
Dermal Contact (Soil)	2.9×10^{-6}
Soil Ingestion	6.1×10^{-7}
Particulate Inhalation	2.3×10^{-9}
Vapor Inhalation (Outdoor)	4.0×10^{-9}
Vapor Inhalation (Indoor)	2.4×10^{-9}
Dermal Contact (Showering/Bathing)	6.8×10^{-6}
Groundwater Ingestion	2.9×10^{-4}
Vapor Inhalation (Showering)	2.6×10^{-4}
Total Risk:	6×10^{-4}

1.0 INTRODUCTION

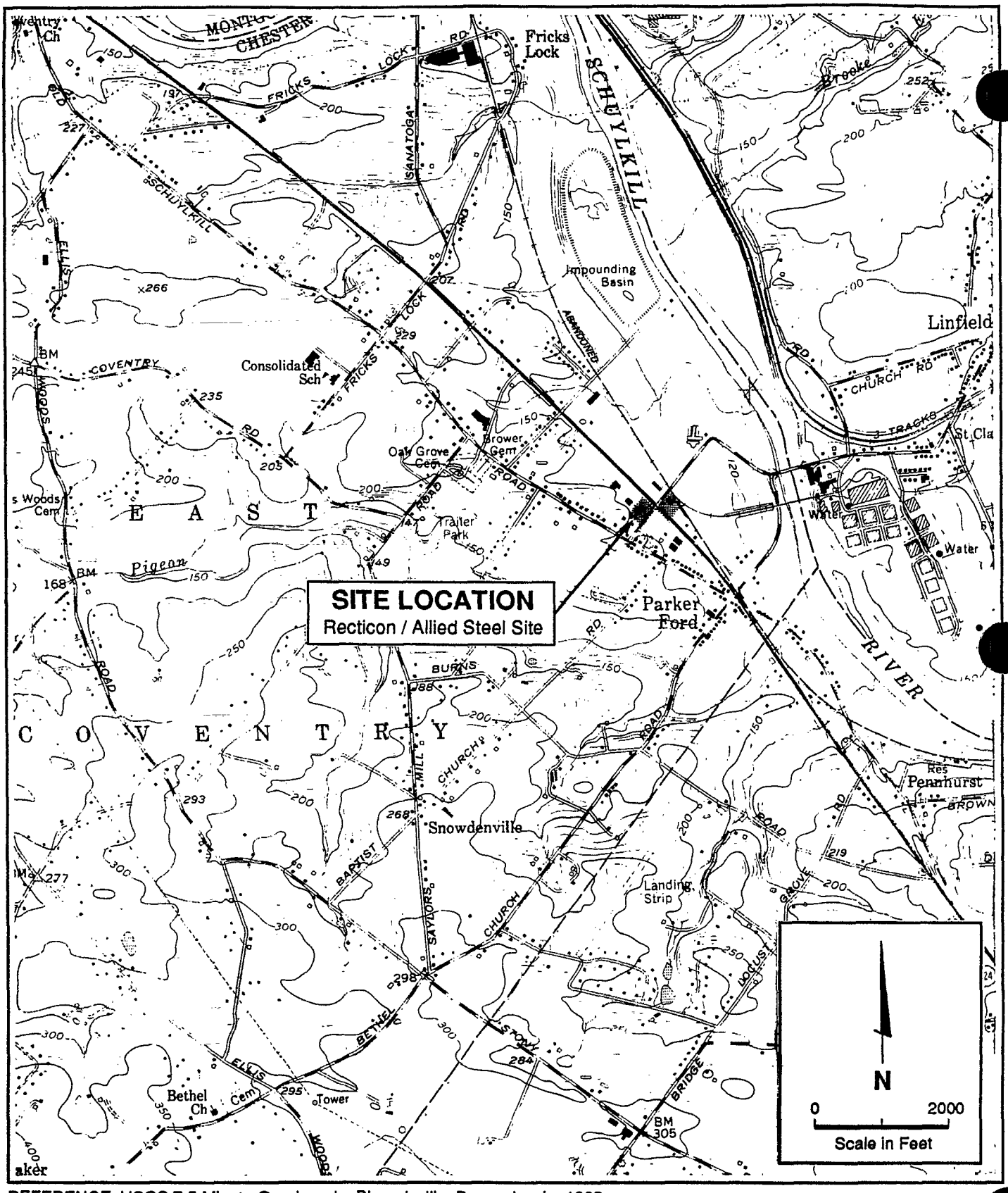
This document presents the Baseline Risk Assessment for the Recticon/Allied Steel Site (the Site) at Parker Ford, Pennsylvania (Figure 1-1). The Remedial Investigation was undertaken for submittal to the United States Environmental Protection Agency (USEPA). The primary purpose of the Baseline Risk Assessment is to provide risk managers with an understanding of the potential human health and environmental risks associated with the Site. The uncertainties associated with the assessment are also presented.

The Site covers an area of approximately 5 acres and consists of two separate facilities at the intersection of Route 724 and Wells Road: the Recticon facility, located at the western corner of the intersection, and the Allied Steel facility, located at the eastern corner of the intersection (Figure 1-2).

1.1 OBJECTIVES

This Baseline Risk Assessment provides an analysis of adverse health and ecological effects and determines the need for action at the Site. Baseline risks are potential adverse effects that might exist if no remediation or institutional controls were applied at a site (EPA, 1989a). The objectives of this assessment are:

- To describe site features as they pertain to assessing human health and ecological effects;
- To identify the chemicals of concern based on the Phase I Remedial Investigation data;
- To evaluate and quantify (where applicable) the potential for and mode of human intake of site chemicals under plausible exposure scenarios;
- To identify applicable health-based criteria to assess the toxicity associated with the chemicals of concern;
- To quantify the non-carcinogenic and carcinogenic health effects associated with potential human contact under the identified exposure scenarios; and
- To qualitatively address the effect of potential chemical contact to ecological receptors.



REFERENCE: USGS 7.5 Minute Quadrangle; Phoenixville, Pennsylvania, 1983.

SITE LOCATION MA

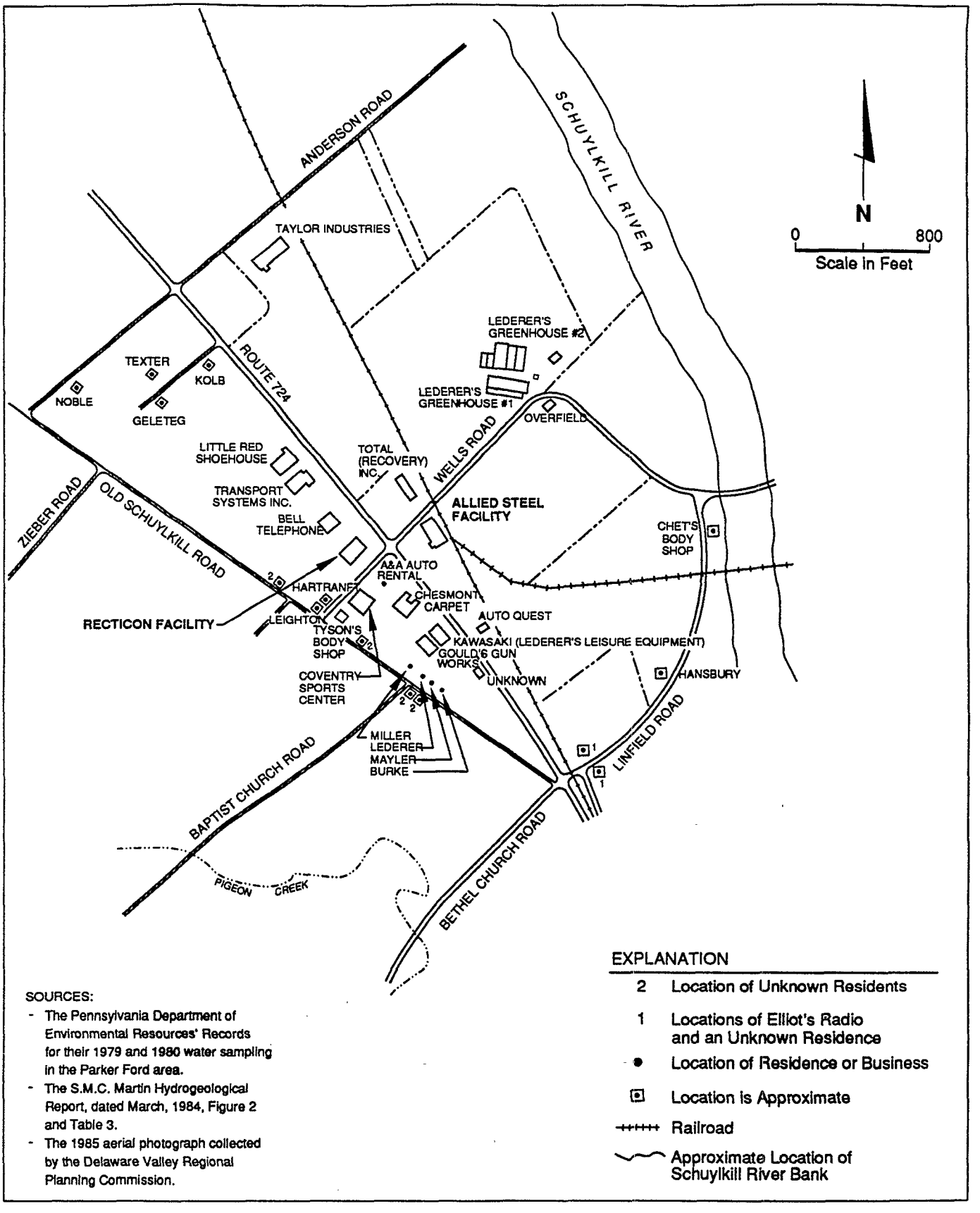
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/28/92 SITE.1

FIGURE 1-1

AR303956



SOURCES:

- The Pennsylvania Department of Environmental Resources' Records for their 1979 and 1980 water sampling in the Parker Ford area.
- The S.M.C. Martin Hydrogeological Report, dated March, 1984, Figure 2 and Table 3.
- The 1985 aerial photograph collected by the Delaware Valley Regional Planning Commission.

EXPLANATION

2	Location of Unknown Residents
1	Locations of Elliot's Radio and an Unknown Residence
•	Location of Residence or Business
⊡	Location is Approximate
++++++	Railroad
~~	Approximate Location of Schuylkill River Bank

SITE VICINITY MAP

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/28/92 SITE

FIGURE 1-2

1.2 REPORT ORGANIZATION

The steps involved in the risk assessment are as follows:

- **Site Description (Section 2.0):** this provides an overview of past, present, and potential future activities at the Site, and identifies important site and vicinity physical and ecological features and land use.

- **Data Collection and Evaluation (Section 3.0):** this step involves gathering and evaluating the Site data (from both current and previous investigations) relevant to the evaluation of health risks, identifying site chemicals of greatest potential health concern, and performing a statistical evaluation of the analytical data.

- **Exposure Assessment (Section 4.0):** an exposure assessment is conducted to identify the pathways through which humans are potentially exposed to chemicals detected at the Site, and to estimate the magnitude, frequency and duration of these potential exposures. Estimates of exposure are developed for both current and future land uses. The exposure assessment involves evaluating chemical migration from the Site, identifying potentially exposed populations and pathways of exposure, estimating exposure point concentrations for specific pathways and estimating chemical intake rates in humans.

- **Toxicity Assessment (Section 5.0):** the toxicity assessment involves the characterization of the toxicological properties and health effects of chemicals with special emphasis on their dose-response relationships. For this assessment, regulatory criteria that reflect the allowable levels of exposure are used to evaluate the potential incidence of adverse health effects at different levels of exposure.

- **Risk Characterization (Section 6.0):** this section combines the results of the exposure and toxicity assessments to characterize baseline health risks. The uncertainties in the risk assessment process and their influence on the characterization of health risks are also discussed.

- **Environmental Evaluation (Section 7.0):** this identifies potentially sensitive non-human species and ecosystems located in the vicinity of the Site and evaluates the potential for exposures of these species to site contaminants.

1.3 REGULATORY GUIDANCE

Investigations at the Site have been conducted pursuant to Sections 104 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC Sections 9604 and 9622 as amended by the Federal Superfund Amendments and Reauthorization Act (SARA).

The National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan, NCP; EPA, 1990a) is the regulation that implements CERCLA, and calls for a site-specific baseline risk assessment to be conducted as a part of the Remedial Investigation (Section 300.430 (d)(1)). The mandate of CERCLA is to protect human health and the environment from current and potential threats posed by uncontrolled hazardous substance releases. In response to this mandate, the U.S. Environmental Protection Agency (EPA) has developed a human health evaluation process as a part of its remedial response process. RAGS (EPA, 1989a) documents this health evaluation process, which is based on well-established chemical risk assessment principles and procedures (NAS, 1983; OSTP, 1985) and regulatory risk assessment guidelines (EPA, 1984; EPA, 1986a-e; EPA, 1988a; EPA, 1989b).

EPA generally uses the results of the baseline risk assessment to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. Correspondingly, if the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicate that risks to human health or the environment are acceptable, then no remedial action is warranted. However, sites that do not warrant action under CERCLA may warrant action under another state or Federal statute.

This Baseline Risk Assessment was prepared in accordance with applicable EPA guidance, including:

- Risk Assessment Guidance for Superfund (RAGS): Volume I, Human Health Evaluation Manual (HHEM) - Part A (EPA/540/1-89/002), December 1989 (EPA, 1989a); and
- RAGS: Volume I, HHEM. Supplemental Guidance, "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991 (EPA, 1991a).

2.0 SITE SETTING

This section provides a summary of the Site based on information presented in the Phase I Remedial Investigation Draft Report, Recticon/Allied Steel Site (Dames & Moore, 1992) (Phase I RI). Section 2.1 describes the regional setting, facility waste handling practices, climate, geology and hydrogeology, demographics and water use, and ecological resources. Section 2.2 describes the history of the Site, including facility waste handling practices and site layout.

2.1 SITE DESCRIPTION

2.1.1 REGIONAL SETTING

The Site is located in Parker Ford, East Coventry Township, Chester County, in southeastern Pennsylvania, at an approximate elevation of 130 feet above mean sea level (Phoenixville 7.5-minute United States Geological Survey (USGS) topographical quadrangle). The topography slopes gently from west to east. The site layout is shown on Figure 2-1.

2.1.2 CLIMATE

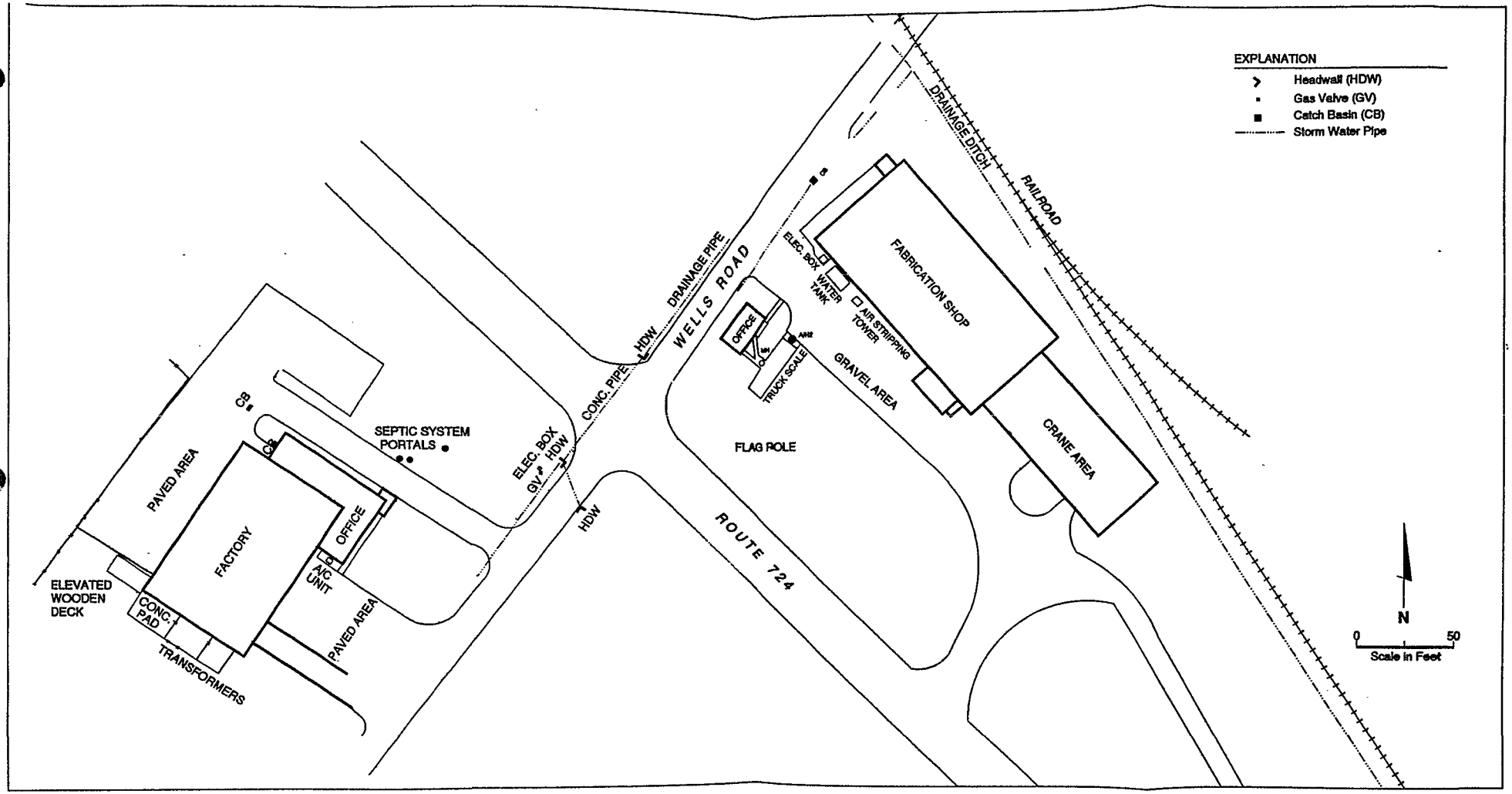
The following information pertains to the town of Phoenixville, which is located 8 miles southeast of the Site:

- Mean temperature is 53.1°F (11°C); normal temperature for January is 30.1°F (-1.1°C); normal temperature for July is 74.9°F (23.8°C); and average rainfall (1850-1885, 1913-1984) was 44.1 inches, evenly distributed throughout the year.

2.1.3 GEOLOGY AND HYDROGEOLOGY

2.1.3.1 REGIONAL GEOLOGY

The area of investigation overlies siltstone and shale of the Triassic Newark/Gettysburg Basin. The formation underlying the basin is the Gettysburg (equivalent to the Brunswick Formation) which



SITE LAYOUT
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE
10839-126-032 SJR 9/24/92 LAYOUT

AR303961

FIGURE 2-1

consists of interbedded reddish-brown shale, siltstone, and mudstone, and may contain green or brown shales. The unconsolidated soil overlying bedrock in the study area is primarily composed of silty clay with gravelly silt and gravelly clay interbeds. Some gravel and silty sand deposits are also present in the unconsolidated soil of the study area. The formation strikes east-west and dips to the north at 12 to 14 degrees.

2.1.3.2 SITE GEOLOGY

The subsurface at the Site consists of silty soil to a depth of approximately 25 to 35 feet below ground surface (bgs), that overlies sedimentary rocks of the Gettysburg Formation. The overburden is composed of clay, silt, and sandy clay interbedded with silty sand, well-graded sand, poorly-graded gravel, and clayey gravel. The bedrock at the Site consists of Triassic red shale interbedded with thinly bedded siltstone. The contact between the bedrock and the overburden is transitional, with varying thicknesses of gravel-sized weathered bedrock fragments in a clay matrix.

2.1.3.3 SITE HYDROGEOLOGY

Groundwater occurs in two discrete zones, the overburden and the shallow bedrock, and preferentially flows toward the east and southeast, respectively. The general vertical groundwater gradient is downward; however, the BR-1/OB-1 well cluster has an upward gradient, probably because the water table is lower in the vicinity of these wells. This may be due to reduced recharge related to the existence of the paved parking lot at the Recticon facility. Based on the groundwater elevation maps in the RI, groundwater is present at the Site approximately 25 to 30 feet below ground surface.

2.1.4 LAND AND WATER USE

Industrial and commercial establishments and single-unit residences exist to the south and west, and farms exist to the north and east, within 0.5 mile of the Site. Two surface water bodies are situated in the site vicinity: the Schuylkill River, approximately 0.25 mile east of the Site, and Pigeon Creek, approximately 0.25 mile south of the Site. Schuylkill River flows to the southeast in the vicinity of the Site.

Groundwater is the primary source of water for businesses and homes surrounding the Site (see Figure 1-2). Private wells pump groundwater from the Brunswick Formation; the nearest private wells coincide with the nearest residences (see the RI for the location of water supply wells). The nearest public water and sewerage systems are located in the more densely populated towns of North Coventry and Spring City, northwest and southeast of the Site, respectively. Spring City is serviced by Citizens Utility Home Water Company, which obtains water from three wells. One of these wells (Well 4) is located approximately 0.75 mile southeast of the Site. A surface water intake is located approximately 1.1 miles southeast of the Site (southeast of Well 4) in the Schuylkill River. Two additional supply wells are located on the western edge of Spring City, and provide water for the Millers Mobile Home Park and Yeagers Trailer Park.

2.1.5 ECOLOGICAL RESOURCES

2.1.5.1 PUBLIC LAND USE

One State Game Land (SGL 234) exists approximately 3,500 feet to the east of the Site, across the Schuylkill River. Within the boundaries of SGL 234 are natural, refuge, and wild areas. Numerous cooperative farm game lands on which game are harvested exist west and south of the Site, the closest being approximately 1,000 feet west. Selected areas of the Schuylkill River are designated as "Scenic" by the Pennsylvania Scenic Rivers Program.

2.1.5.2 HABITAT DELINEATION

The Site does not provide substantial wildlife habitat (see Figure C-1). Emergent wetlands with some Scrub/Shrub wetlands were identified at the Site, but are limited to a 0.1-acre portion of the Allied Steel facility associated with a drainage ditch. Vegetation in the drainage ditch area is mowed on a semi-regular basis; therefore, vegetation is not well established. Soils and hydrology information were relied upon to delineate the wetlands boundary on the site. The nearest offsite wetlands lie approximately 2,500 feet to the east of the Allied Steel facility at the Schuylkill River. Ecological resources are discussed further in Section 7.0.

2.2 SITE HISTORY

This section presents an overview of the history of the Recticon/Allied Steel Site, along with a description of the waste handling practices of each facility. Figure 2-1 shows that layout of both facilities.

2.2.1 FACILITY OVERVIEW

2.2.1.1 RECTICON FACILITY

Recticon, a former subsidiary of Rockwell, manufactured silicon wafers at the facility between 1974 and 1981. During that time, Recticon leased the facility from Highview Gardens, Inc. of Fairview Village, Pennsylvania. A history of the facility owners and occupants of the facility since 1969 is as follows:

- *September 11, 1969:* Mr. Elton MacKissic and Ms. Violet MacKissic sold the property to Highview Gardens, Inc. (Highview).
- *1971:* Present building was constructed.
- *March 1, 1971:* Highview leased the property to Varadyne Industries, Inc. Varadyne lease expiration date was February 28, 1976.
- *March 5, 1974:* Varadyne subleased the facility to Recticon.
- *March 1976:* Recticon leased the facility for 2 years.
- *January 1978:* Recticon lease extended.
- *March 1980:* Lease extended.
- *January 1981:* Lease extended.
- *April 1981:* Recticon lease expired.
- *April 1981 to June 1989:* Several unnamed tenants occupied the facility.

- *June 1989:* First Oxford Management Group leased the property (beginning date of lease unknown).

- *Present:* Facility most recently occupied by Coventry Custom Kitchens; now appears to be vacant.

The major features of the Recticon facility are a one-story building with manufacturing and office areas, a southeast parking lot and loading area, electrical transformers, a septic system, and a paved driveway. Approximately 40,500 ft^2 of the approximately 82,500-ft^2 facility is paved or covered by buildings; the remaining 42,000 ft^2 is covered by grass and shrubs which are maintained as landscaping (Figure 2-1). The Site formerly contained two waste settling basins at the southeast side of the building and a gravel-topped area directly northeast of the drum storage area. A drainage ditch is present along the southeast edge of the property. The drainage ditch is dry for most of the year. A groundwater production well exists at the facility.

2.2.1.2 ALLIED STEEL FACILITY

Allied Steel Corporation purchased the property in the early 1970s, and fabricated steel at the facility from 1972 to approximately 1988. Information regarding former owners is currently not available.

The major features of the facility include a building (a fabrication shop and an office), a gravel parking lot and driveway, a septic system, a scale pit, and a crane area and concrete pad (Figure 2-1). Approximately 17,000 to 27,000 ft^2 of the approximately 107,100-ft^2 facility is paved or covered by buildings; approximately 80,000 to 90,000 ft^2 is uncovered. Surface water run-off flows either toward a drainage culvert parallel to Wells Road, or to a drainage ditch which parallels the railroad tracks north of the facility. The culvert and ditch collect drainage from the Allied Steel and Recticon facilities and offsite sources, including Total Recovery, Inc., located north of the Allied Steel facility. Three groundwater production wells exist at the facility: PW1 (south of the fabrication shop); PW2 (housed within the fabrication shop); and PW3 (southwest of the fabrication shop).

2.2.2 WASTE HANDLING PRACTICES

This summary of waste handling practices is based on information compiled in the Phase I RI.

2.2.2.1 RECTICON FACILITY

The production of silicon wafers resulted in at least four waste streams:

- Waste acidic and caustic solutions;
- "Dragout water";
- Polishing slurry; and
- Waste trichloroethene (TCE) or waste solvents containing TCE.

Information on these waste streams is summarized in the following table.

Waste Stream	Chemical Components	Amount of Chemical Discharged	Fate of Discharge
Waste acidic and caustic solutions	Hydrofluoric acid Nitric acid Acetic acid Chromic acid Ammonium hydroxide Potassium hydroxide Sodium hydroxide Colloidal silica	Unknown	Hauled offsite
"Dragout water"	Trace acids and caustics	Unknown	Drainage ditch
Polishing slurry	Colloidal silica	Unknown	Outside of building in unknown locations
Waste TCE or solvents	TCE "Safety Solvent" "Dupont Freon TF Solvent"	2 gal/day TCE	55-gallon storage drums (TCE)

TCE and other solvents were shipped and stored in 55-gallon drums. These drums were stored in a small room adjacent to the loading dock, in another small room between the polishing room and an exit door near Well 1, in the loading dock area (within the facility), and in an unknown location outside of the plant. The use of TCE was generally restricted to the cutting and polishing areas of the facility, to which TCE was transported from the storage area in 1-quart dipping vats. Spent TCE was returned to the drums in the storage area. TCE in dragout water was occasionally discharged to surface drainages. Upon discontinuation of the use of TCE at the facility, solvents were transported within the facility in 1-gallon containers. The floor drains in the use and storage areas are unbermed and are connected to process waste lines 3 and 4.

2.2.2.2 ALLIED STEEL FACILITY

The Allied Steel facility generated at least three waste streams, as reported in Pennsylvania Department of Environmental Resources (PADER) Inspection Reports from November 21, 1978, through August 22, 1980:

- Waste "SAF-T-SOLVENT";
- Air compressor contact water; and
- Vessel testing water.

Information on these waste streams is presented in the following table.

Waste Stream	Chemical Components	Amount of Chemical Discharged	Fate of Discharge
"SAF-T-SOLVENT" (for cleaning parts)	10% TCE, 30% 1,1,1-trichloroethane, 60% high-flash naphtha	Unknown	1. 55-gallon drums (near air compressor) 2. Ground, for dust control
Air compressor contact water	Oil, carbon	Approximately one gallon per day	1. Ground surface 2. Hauled offsite
Vessel testing water	Unknown	Unknown	Ground surface

3.0 DATA COLLECTION AND EVALUATION

This section evaluates the available analytical data for groundwater, surface water and sediments, soils, and soil gas, as well as the historical information on chemical use in order to define the chemicals of concern for the Recticon and Allied Steel facilities. The chemicals of concern represent site-associated chemicals that could pose health risks to potentially exposed populations. The analytical results for chemicals detected during the Phase I RI are presented in Attachment A (please refer to Section 4 of the Phase I RI report for additional details). The sampling locations referred to in the following sections are depicted in Attachment B.

3.1 DISCUSSION OF THE AVAILABLE DATA

The Phase I RI included collection and analysis of site samples from groundwater and from potential source media including surface water and sediments, subsurface soil, and soil vapor. All groundwater, surface water and sediment, and soil samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals; the samples were validated using Contract Laboratory Program (CLP) procedures. As part of the CLP data validation, qualifier codes were assigned to each analytical result, as appropriate, to facilitate data interpretation. The qualifier codes are explained in Attachment A (please see footnotes for Tables A-1 through A-7). Analytical results reported with a "U" qualifier (in addition to any other qualifiers) are detection limits, and were treated as nondetects. Values with any qualifiers except for "U" were treated as detects.

Soil vapor samples were collected mainly to aid in the location of soil samples, and were analyzed for ten indicator VOCs: chloroform, carbon tetrachloride, 1,1,1-trichloroethane (TCA), trichloroethene, tetrachloroethene (also known as perchloroethylene, and abbreviated as PCE), vinyl chloride, benzene, toluene, ethylbenzene, and xylene. Soil vapor samples were analyzed using a field gas chromatograph. The field and quality assurance procedures, and the quality assurance review of the soil vapor data are presented in Appendix D of the Phase I RI report.

The specific rationale for each of the sampling programs during the Phase I RI was as follows:

- **Surface Water and Surface Soil.** The RI included testing of water and soil samples from surface drainages, because a review of the historic operational practices indicated that wastewater was occasionally discharged to these drainages. Previous sampling conducted in 1980 by Roy F. Weston, Inc. on behalf of Recticon revealed the presence of chlorinated hydrocarbons in culverts; TCE concentrations ranged from less than 1 μg/l to 229 μg/l.

- **Soil Vapor and Subsurface Soil.** Soil vapor and subsurface soil samples were collected mainly to identify any remaining source areas in site soil. Therefore, a biased sampling strategy was employed. Soil borings were located based on the results of the soil vapor survey and review of site features such as the location of septic fields. Soil samples were collected from the soil borings based on field screening with an organic vapor analyzer.

- **Groundwater.** To evaluate the hydrogeology and groundwater quality of the aquifers that underlie the Site, eight overburden wells and eight shallow bedrock wells were installed. The overburden wells were installed to a depth of approximately 30 feet bgs, and the shallow bedrock wells were installed to a depth of approximately 65 feet bgs. The overburden and shallow bedrock wells were constructed as paired well clusters.

  Groundwater samples were collected from the 16 monitoring wells on four occasions to evaluate seasonal or statistical variations. Groundwater was sampled in April, July, September, and November of 1991. The first round of groundwater samples was analyzed for TCL VOCs, SVOCs and metals. Upon consultation with EPA, only VOCs were analyzed in subsequent sampling rounds, because review of the April 1991 sampling data indicated that SVOCs and metals were not present at concentrations that would be of concern.

Offsite production wells in the site vicinity are monitored regularly as part of a Removal Action based on an Administrative Order by Consent between Rockwell and EPA Region III. Production wells in which TCE was detected at concentrations above the MCL were provided with carbon filtration, and are monitored quarterly for the presence of VOCs. Twenty-two wells which supply other residences and businesses near the Site have not been provided with carbon filtration, but are monitored semi-annually for VOCs. Both quarterly and semi-annual monitoring samples are collected at the tap. In addition, mid-filter samples are also collected as part of the quarterly monitoring program. EPA Method 601/602 is used to analyze the offsite water supplies for VOCs.

Tap water samples from wells with filtration systems have not contained detectable VOC concentrations except for occasional low detections of acetone and methylene chloride, which are common laboratory contaminants. Low concentrations of 1,1,1-trichloroethane, methylene chloride, toluene, and trichloroethene have been detected in unfiltered samples. The risks associated with unfiltered samples are addressed in the risk assessment (please see Section 3.2.6).

3.2 DATA EVALUATION

This section discusses the evaluation of the chemical data for spatial and temporal trends which could shed light on the likely source of chemicals detected, and for average and extreme concentrations which could be contacted by human or ecological receptors. The quality control data were also evaluated for possible laboratory contamination and for results that may be biased, and the analytical detection limits were evaluated, so that non-detected concentrations could be estimated. The data evaluation is discussed below for each of the environmental media monitored at the Site.

3.2.1 WATER IN SURFACE DRAINAGES

One upgradient water sample (SW-1) and one downgradient sample (SW-2) were collected from the drainage ditch that runs between the Allied Steel facility and the railroad tracks. Figure B-1 shows the sample locations. Chemicals detected in the surface water sampling are shown in Table A-1, and are summarized in Table 3-1.

The surface water samples did not appear to contain any elevated concentrations. Two VOCs, acetone and chloroform, were detected at similar concentrations in both the Site and blank samples. Two SVOCs, diethylphthalate and bis(2-ethylhexyl)phthalate were detected only in the upgradient (background) sample. Since phthalates are common laboratory contaminants, the concentrations detected in background surface water samples are likely to originate from laboratory contamination. Inorganic constituents were detected at similar levels in both the upgradient and downgradient samples, which suggest that they most likely represent naturally occurring levels.

3.2.2 SOIL IN SURFACE DRAINAGES

Three upgradient soil samples (R/SS-7A, R/SS-7B, and R/SS-7C) and one downgradient sample (R/SS-2) were collected from the drainage ditch that runs along Wells Road past the Recticon facility (please see Figure B-1). In addition, one upgradient soil sample (A/SS-3) and three downgradient samples (A/SS-4, A/SS-5 and A/SS-6) were collected from the drainage ditch that runs between the Allied Steel facility and the railroad tracks. The potentially impacted locations A/SS-4, A/SS-5 and A/SS-6 are downgradient of both the Recticon and Allied Steel facilities. Results of the surface soil sampling are shown in Tables A-2 and A-3, and are summarized in Tables 3-2 and 3-3.

VOCs were not detected in surface soil with the exception of TCE (at 0.002 and 0.005 mg/kg, respectively in one upgradient and one downgradient sample) and acetone (in one upgradient and two downgradient samples). Benzoic acid, bis(2-ethylhexyl)phthalate, and butylbenzylphthalate were also detected in both upgradient and downgradient samples. Di-n-butylphthalate was detected only in two downgradient samples. Polycyclic aromatic hydrocarbons (PAHs) and metals were generally detected in both upgradient and downgradient samples.

The concentrations of PAHs, bis(2-ethylhexyl)phthalate and some metals (chromium, calcium, copper, iron, lead, magnesium, nickel, and zinc) appear somewhat higher in the downgradient samples. However, the extent to which site activities may have increased chemical concentrations in drainage soils has not been determined. These chemicals may have originated from other anthropogenic sources not related to the Site. At this particular site, PAH concentrations detected in soil may originate from automobile exhaust. The downgradient samples for the Recticon facility were collected near a major thoroughfare (Route 724) and would therefore tend to have higher PAH concentrations than the upgradient samples which were collected near a quiet residential street (Wells Road). Surface soil samples for the Allied Steel facility were collected along a railroad, which is another source of fuel combustion that would produce PAHs.

Results for polycyclic aromatic hydrocarbons (PAHs) and some inorganics in some surface soil samples were qualified as possibly biased low. However, it is unlikely that these qualified data contribute significantly to the uncertainty for this risk assessment, because these data 1) represent relatively small areas, and 2) may represent non-site related sources (*e.g.*, for PAHs). The contribution of these chemicals to total risk is shown in Section 6.0.

3.2.3 SOIL VAPOR

The soil vapor samples were collected on a square 40-foot grid system established for each facility (see Figures B-2 and B-3). A total of 56 sampling locations at the former Recticon facility were evaluated. At the Allied Steel facility, a total of 54 sampling points were evaluated, and the grid samples were concentrated in the immediate plant area. Additional samples were collected at each facility in suspected source areas. Samples were collected from soil probes at depths of three to six feet bgs. Results of the soil vapor sampling are shown in Table A-4. The soil vapor data summary is presented in Table 3-4.

Based on the pattern of VOC concentrations in soil vapor shown on the contour maps (please see Figures 4-4 through 4-8 of the Phase I RI), soil vapor concentrations were generally higher under the parking lot and pavement on either side of the building than in the unpaved (*i.e.*, grass) areas of the Recticon facility. The maximum TCE concentration was detected at a depth of three feet below grade. These data could also represent shallower depths, since soil vapor was not tested above three feet below grade.

Quality control samples that were analyzed as part of the soil vapor survey included system blanks and "air" samples (Table A-5). Chemicals detected in air samples could represent either equipment contamination or ambient concentrations in air. Carbon tetrachloride and 1,1,1-TCA were detected at similar concentrations in both soil vapor and air samples.

3.2.4 SUBSURFACE SOIL

A total of six soil samples were collected from five soil borings which were drilled on the Recticon facility (Figure B-2). Seven soil samples were collected from the four soil borings drilled on the Allied Steel property.

VOC detections in subsurface soil are presented by boring location and depth in Table A-6, and are summarized in Table 3-5. Only one significant TCE source area was detected: 1400 μg/kg TCE at 9 to 11 feet bgs in boring R/A7 from the Recticon facility. *Cis*-1,2-dichloroethene (*cis*-1,2-DCE) (total) was also detected in this sample at 48 μg/kg. Acetone was detected at a concentration of 114 μg/kg in a sample from boring R/G2 at 8 to 10 feet bgs. This is the only subsurface soil sample from either facility in which acetone was detected at a concentration that is significantly above the concentrations detected in associated blanks.

The soil boring data represent biased sampling where contamination was indicated by the soil vapor survey, or was suspected from historical information. Therefore, the VOC detections probably represent the maximum VOC concentrations in soil that remain on the Site.

3.2.5 ONSITE GROUNDWATER

Figures 4-32 and 4-33 of the Phase I RI show the distribution of total VOCs in the overburden and bedrock wells, respectively, for the April 1991, July 1991, September 1991, and November 1991 groundwater sampling events.

Review of the data (see Table A-7) indicates that in general TCE and *cis*-1,2-DCE account for at least 90 percent of the total VOC concentrations. Although similar chemicals were detected, VOC concentrations were generally somewhat higher in the shallow bedrock than in the overburden samples.

The groundwater data in the shallow bedrock aquifer indicate a plume which extends across the Recticon and Allied Steel facilities along Route 724. The overburden data indicate a generally similar pattern; however, concentrations were relatively low in two of the wells (OB-3 and OB-5) which are located between the facilities, and in the center of the shallow bedrock plume. The concentrations over time have been variable, with a possible decreasing trend.

Arithmetic average and 95 percent upper confidence limit (UCL) concentrations are shown for each of the shallow bedrock and overburden aquifers in Tables 3-6 and 3-7, respectively. The UCL concentrations were calculated based on the average concentration detected over time in each well. To calculate well averages, nondetected concentrations for chemicals of concern in the aquifer were assumed to be present at one-half the sample quantitation limit. However, in accordance with EPA guidance (EPA, 1989a), nondetected results were excluded from the calculation in cases where the sample quantitation limit exceeded the maximum detected concentration for the well, due to sample dilution. Therefore, in some cases, the well average represents fewer than four sampling events.

The average and UCL concentrations were calculated for all of the monitoring wells on the Site. The data from these wells indicate that VOC concentrations vary significantly across the Site. However, the UCLs are similar to the concentrations detected in the center of the plume.

3.2.6 OFFSITE WATER SUPPLIES

A risk calculation was also performed for chemicals that were detected at the tap in 22 business/residential water supplies which are monitored semi-annually as part of the Removal Action. These chemical detections are summarized in Table 3-8. TCE has been detected at 1 μg/l in several of the water supplies that are monitored semi-annually. Other chemicals could be present below the detection limit. However, these chemicals are likely to be present at some fraction of the TCE concentration, given the relative concentrations in onsite samples.

3.3 RATIONALE FOR THE SELECTION OF CHEMICALS OF CONCERN

This section discusses the rationale for the choice of chemicals of concern for the Recticon and Allied Steel facilities. Generally, chemicals of concern are chosen based upon several selection criteria (EPA 1989a), as follows:

1) Chemicals not expected to be present in regional background samples are considered chemicals of concern if they were detected at least once at levels significantly greater than sample blanks;

2) For chemicals expected or known to be present regionally, the chemical should also be detected at levels significantly greater than levels found in background samples; and

3) A chemical that has not been detected at a site may also be a chemical of concern, if it is expected to be present based upon historical chemical usage at a site, or if it is a known chemical transformation product of another chemical of concern.

Tables 3-1 through 3-7 summarize the data collected in the RI for chemicals that were detected at concentrations significantly above blanks. With the exception of chemicals that are classified as nutrients, the list of chemicals of concern includes all chemicals that were detected at concentrations significantly above blanks. In addition, two of the VOCs that were detected in subsurface soil, 1,2-DCE and acetone, were not tested in the soil vapor survey, but are considered as chemicals of concern in air because they were detected in soil boring samples. The soil boring data were used as model inputs to estimate soil gas concentrations for 1,2-DCE and acetone. The chemicals of concern are listed in Section 4.4.

One list of chemicals of concern was evaluated for both the Recticon and Allied Steel facilities in surface water, surface soil, and groundwater. The Recticon and Allied Steel facilities were operated independently, and differences in the chemicals and procedures used at each facility would influence the nature of contamination from the two facilities. To the extent appropriate, the facilities were examined separately; however, certain site media (*i.e.*, surface soil, surface water, and groundwater) were necessarily evaluated collectively. For example, the RI identified a plume of groundwater contaminants which spans the area beneath both the Recticon and Allied Steel facilities. This plume extends upgradient of the Site, and may originate, at least in part, from upgradient sources. In addition, most of the soil and

water samples collected from the drainage ditch were located downgradient of both the Recticon and Allied Steel facilities. Furthermore, based on the data from both upgradient (*i.e.*, background) and downgradient locations, the surface soil in general appears impacted by anthropogenic sources (in particular, automobile exhaust) that are not site-related. Therefore, since similar concentrations were detected near both facilities, and multiple sources are probably involved, the risk assessment used the same data to evaluate risks from chemicals in groundwater and surface drainages for both the Recticon and Allied Steel facilities.

The data for chemicals in subsurface soil and soil gas were evaluated separately for the Recticon and Allied Steel facilities. Chemicals in subsurface soil and soil gas are clearly associated with each individual facility. Moreover, most of the potential exposure from these media would occur within the boundaries of the individual facilities.

The details of the blank comparisons are discussed in Section 3.3.1. Section 3.3.2 is a qualitative discussion of possible upgradient or background concentrations. Chemicals that are classified as nutrients are discussed in Section 3.3.3.

3.3.1 COMPARISONS WITH BLANKS

EPA guidance for the application of data to risk assessment (EPA, 1989a; 1990b) provides the following specific guidance for correcting for blank contamination:

- **Blanks containing common laboratory contaminants.** If blanks contain detectable levels of common laboratory contaminants as defined by EPA (1989a), *i.e.*, acetone, 2-butanone (or methyl ethyl ketone), toluene, and the phthalate esters, then the sample results are considered as positive results only if the concentrations in the sample exceed ten times the maximum amount detected in any blank. If the concentration of a common laboratory contaminant is less than ten times the blank concentration, then the chemical is considered to be not detected in the particular sample, and the blank-related concentration of the chemical is considered to be the quantitation limit for the chemical in that sample. If all samples contain levels of a common laboratory contaminant that are less than ten times the level of contamination noted in the blank, then the chemical is completely eliminated from the set of sample results.

- **Blanks containing chemicals that are not common laboratory contaminants.** If blanks contain detectable levels of chemicals that are not considered common laboratory contaminants by EPA (1989a), *i.e.*, all other chemicals on the TCL, then the sample results are considered as positive results only if the concentrations in the sample exceed five times the maximum amount detected in any blank. If the concentration of a common laboratory contaminant is less than five times the blank concentration, then the chemical is considered to be not detected in the particular sample, and the blank-related concentration of the chemical is considered to be the quantitation limit for the chemical in that sample. If all samples contain levels of a common laboratory contaminant that are less than five times the level of contamination noted in the blank, then the chemical is completely eliminated from the set of sample results.

The comparisons for blank contamination are shown in Tables A-1 through A-7. Chemicals that were frequently detected in blanks include chloroform, acetone, methylene chloride, toluene, and the phthalate esters. Carbon disulfide was also reported as a Tentatively Identified Compound[1] (TIC) in both groundwater samples and associated blanks. TCE and *cis*-1,2-DCE were detected in blanks associated with groundwater samples collected in the July 1991 sampling round.

In some cases, chemicals that are likely laboratory contaminants (such as the phthalate esters) could not be eliminated from the set of sample results because they were not detected in an associated blank for one or more of the environmental samples. This is quite likely to occur for laboratory contaminants because fewer blanks than environmental samples are tested. Only two SVOCs were detected in groundwater: dimethylphthalate in one sample from the bedrock aquifer; and bis(2-ethylhexyl)phthalate in five samples from the overburden aquifer. These chemicals were not detected in the associated blanks, and were therefore retained in the risk assessment calculations.

In the case of the soil vapor data, system blanks were only available for two of the 11 days on which samples were collected. Air samples were collected each day, but could reflect Site influences as well as ambient air conditions and equipment contamination. Therefore, chemicals were not eliminated from the risk assessment based on detection in the air samples. However, because carbon tetrachloride was detected in most of the air samples and soil vapor samples at similar concentrations, and was not detected in other Site media, the carbon tetrachloride detections are likely false positives.

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[1]TICs are compounds that are not on the EPA TCL, but are indicated to be potentially present in a sample by chromatogram peaks which occur during sample analysis.

3.3.2 Qualitative Discussion of Upgradient and Background Concentrations

Because site-specific background data were not available for groundwater and subsurface soil, all of the chemicals detected at concentrations significantly above blanks were retained in the risk assessment calculations for these media. However, qualitative statements can be made to characterize the contamination on the Site. The RI notes that the inorganic concentrations detected are within the range expected for naturally occurring levels, so these inorganic constituents should not contribute substantially to adverse health effects in excess of non-site related concentrations.

Several potential upgradient sources of VOCs in groundwater have been identified by the RI, and could be contributing to the VOC concentrations detected at the Site. This is an uncertainty that would lead to overestimation of the risk associated with the Site. However, no chemicals were eliminated as chemicals of concern in groundwater based on background concentrations.

3.3.3 Elimination of Essential Nutrients

Several metals that are essential nutrients were eliminated as chemicals of concern in drinking water, because adverse effects from these metals are only seen at high concentrations. No reference doses or slope factors are available for these compounds (please see Section 5.0 for an explanation of these terms). The nutrients eliminated are:

- Calcium;
- Iron;
- Magnesium;
- Potassium; and
- Sodium.

3.4 UNCERTAINTIES RELATED TO THE DATA EVALUATION

Several uncertainties that are associated with the data evaluation are discussed in the preceding sections, and can be summarized as follows:

- The presence of qualified data may result in underestimation or overestimation of risks.
- The inability to identify some laboratory or equipment contaminants is an added uncertainty which tends to overestimate the risk associated with the Site.
- The potential upgradient sources of VOCs in groundwater may lead to overestimation of the risk associated with the Site.
- The lack of background data contributes to the uncertainty associated with the metals in soil and groundwater.

Additional uncertainty derives from structure of the sampling program. The Phase I RI did not include sampling in surface soil across the Site (only the drainage ditches were sampled), because no source of metals and SVOCs to site soils was identified, and also because the presence of VOCs in soil could be determined from the soil vapor samples. The sampling of surface soil in selected areas of the Site (*i.e.*, drainages) may underestimate the potential risks from exposure to surface soil at the largely unpaved Allied Steel facility.

Table 3-1
Summary of Chemicals Detected in Surface Water Samples from Upgradient and Downgradient Drainage Locations at the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations
METALS (total)			
Aluminum	2 of 2	-	1550 - 2250
Barium	2 of 2	-	51.7 - 55.6
Cadmium	1 of 2	4	4.9
Chromium	2 of 2	-	6.6 - 10.6
Copper	2 of 2	-	87.6 - 90.2
Lead	2 of 2	-	7.4 - 20.6
Manganese	2 of 2	-	200 - 245
Selenium	1 of 2	2	2.6
Vanadium	2 of 2	-	6.1 - 9.9
Zinc	2 of 2	-	72.3 - 116
METALS (dissolved)			
Aluminum	1 of 2	33	64.7 - 2250
Barium	2 of 2	-	30.7 - 55.6
Copper	2 of 2	-	30.4 - 192
Manganese	2 of 2	-	115 - 156
Vanadium	1 of 2	5	5.3
Zinc	2 of 2	-	24.7 - 41.6
SVOCs			
bis(2-ethylhexyl)phthalate	1 of 2	10	1
Diethylphthalate	1 of 2	10	1
VOCs			
Acetone	2 of 2	-	8 - 14

Data summarized from Table 4-3 of the RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Table 3-2
Summary of Chemicals Detected in Surface Soil Samples from Upgradient and Downgradient Drainage Locations at the Recticon/Allied Steel Site

Chemical	Allied Steel			Recticon		
	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations
METALS (mg/kg)						
Aluminum	4 of 4	-	9870 - 11500	4 of 4	-	6290 - 11600
Arsenic	4 of 4	-	2 - 6	2 of 4	0.48 - 1.4	2.1 - 2.6
Barium	4 of 4	-	115 - 178	4 of 4	-	92.5 - 139
Beryllium	3 of 4	0.66	1 - 2.8	3 of 4	0.52	0.68 - 0.83
Cadmium	1 of 4	1.2 - 1.4	1.4	0 of 4	0.97 - 1	-
Chromium	4 of 4	-	19.9 - 80.7	4 of 4	-	9.5 - 75.4
Cobalt	4 of 4	-	10.8 - 15.7	4 of 4	-	9.8 - 14.1
Copper	4 of 4	-	43.3 - 211	4 of 4	-	4.3 - 92.1
Lead	4 of 4	-	60.7 - 151	4 of 4	-	30.2 - 74
Manganese	4 of 4	-	356 - 1500	4 of 4	-	642 - 1310
Nickel	4 of 4	-	15.9 - 28.7	4 of 4	-	10.5 - 18.4
Vanadium	4 of 4	-	24.9 - 30.2	4 of 4	-	16.9 - 27.1
Zinc	4 of 4	-	111 - 772	4 of 4	-	38 - 123
PAHs (ug/kg)						
2-Methylnaphthalene	2 of 4	590 - 1100	250 - 700	0 of 4	410 - 440	-
Acenaphthylene	4 of 4	-	230 - 330	2 of 4	430 - 440	140 - 350
Anthracene	4 of 4	-	150 - 320	2 of 4	430 - 440	77 - 210
Benzo(a)anthracene	4 of 4	-	300 - 900	2 of 4	430 - 440	200 - 1000
Benzo(a)pyrene	4 of 4	-	490 - 900	2 of 4	430 - 440	250 - 1200
Benzo(b)fluoranthene	4 of 4	-	1200 - 2000	3 of 4	430	110 - 1400
Benzo(g,h,i)perylene	4 of 4	-	250 - 810	1 of 4	430 - 440	690
Benzo(k)fluoranthene	0 of 4	550 - 1100	-	1 of 4	430 - 440	950
Chrysene	4 of 4	-	520 - 1000	3 of 4	430	60 - 1000
Dibenz(a,h)anthracene	2 of 4	550 - 1100	63 - 230	0 of 4	410 - 440	-
Dibenzofuran	2 of 4	590 - 1100	110 - 300	0 of 4	410 - 440	-
Fluoranthene	4 of 4	-	720 - 1600	3 of 4	430	68 - 1300
Fluorene	1 of 4	550 - 1100	120	0 of 4	410 - 440	-
Indeno(1,2,3-cd)pyrene	4 of 4	-	260 - 1100	0 of 4	410 - 440	-
Naphthalene	2 of 4	590 - 1100	110 - 400	0 of 4	410 - 440	-
Phenanthrene	4 of 4	-	290 - 1600	2 of 4	430 - 440	94 - 330
Pyrene	4 of 4	-	100 - 1600	2 of 4	430	98 - 1200
SVOCs (ug/kg)						
Benzoic Acid	1 of 4	2700 - 5600	260	1 of 4	2000 - 2100	250
bis(2-ethylhexyl)phthalate	4 of 4	-	220 - 930	3 of 4	430	46 - 560
Butylbenzylphthalate	3 of 4	950	140 - 390	1 of 4	430 - 440	92
Di-n-butylphthalate	1 of 4	590 - 1100	73	1 of 4	430 - 440	99
VOCs (ug/kg)						
Acetone	1 of 4	14 - 33	25	2 of 4	13	18 - 140
Trichloroethene	2 of 4	7 - 9	2 - 5	0 of 4	6 - 7	-

Data summarized from Table 4-3 of the RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Note: Samples collected downgradient of the Allied Steel facility are also downgradient of the Recticon facility.

Table 3-3
Comparison of Upgradient and Downgradient Samples: Chemicals Detected in Surface Soil from Drainages at the Recticon and Allied Steel Facilities

Chemical (Units in mg/kg)	Allied Steel				Recticon			
	UPGRADIENT	DOWNGRADIENT			UPGRADIENT		DOWNGRADIENT	
	Detected Values	Frequency of Detection	Range of Detection Limits*	Range of Detected Values	Frequency of Detection	Range of Detection Limits*	Range of Detected Values	Detected Values
METALS								
Aluminum	11500	3 of 3	-	9870 - 11400	3 of 3	-	6290 - 11600	8450
Arsenic	2.500	3 of 3	-	2.0 - 6.0	1 of 3	0.48 - 1.4	2.6	2.100
Barium	155	3 of 3	-	115 - 178	3 of 3	-	92.5 - 139	93.7
Beryllium	1.000	2 of 3	0.66	1.8 - 2.8	2 of 3	0.52	0.68 - 0.83	0.770
Cadmium	(1.400)	1 of 3	1.2 - 1.3	1.4	0 of 3	0.97 - 1.0	-	(1.200)
Chromium	19.9	3 of 3	-	32.1 - 80.7	3 of 3	-	9.5 - 14.8	75.4
Cobalt	11.9	3 of 3	-	10.8 - 15.7	3 of 3	-	9.8 - 14.1	12.2
Copper	43.3	3 of 3	-	124 - 211	3 of 3	-	4.3 - 20.8	92.1
Lead	60.7	3 of 3	-	104 - 151	3 of 3	-	30.2 - 74	57.9
Manganese	969	3 of 3	-	356 - 1500	3 of 3	-	642 - 1310	768
Nickel	15.9	3 of 3	-	19.8 - 28.7	3 of 3	-	10.5 - 15.1	18.4
Vanadium	24.9	3 of 3	-	27.8 - 30.2	3 of 3	-	16.9 - 27.1	23.7
Zinc	111	3 of 3	-	346 - 772	3 of 3	-	38 - 92.1	123
PAHs								
2-Methylnaphthalene	(0.590)	2 of 3	1.1	0.25 - 0.7	0 of 3	0.43 - 0.44	-	(0.410)
Acenaphthylene	0.230	3 of 3	-	0.24 - 0.33	1 of 3	0.43 - 0.44	0.14	0.350
Anthracene	0.150	3 of 3	-	0.22 - 0.32	1 of 3	0.43 - 0.44	0.077	0.210
Benzo(a)anthracene	0.300	3 of 3	-	0.41 - 0.9	1 of 3	0.43 - 0.44	0.2	1.000
Benzo(a)pyrene	0.490	3 of 3	-	0.66 - 0.9	1 of 3	0.43 - 0.44	0.25	1.200
Benzo(b)fluoranthene	1.200	3 of 3	-	1.6 - 2.0	2 of 3	0.43	0.11 - 0.56	1.400
Benzo(g,h,i)perylene	0.250	3 of 3	-	0.42 - 0.81	0 of 3	0.43 - 0.44	-	0.690
Benzo(k)fluoranthene	(0.590)	0 of 3	0.55 - 1.1	-	0 of 3	0.43 - 0.44	-	0.950
Chrysene	0.520	3 of 3	-	0.71 - 1.0	2 of 3	0.43	0.06 - 0.25	1.000
Dibenz(a,h)anthracene	0.063	1 of 3	0.55 - 1.1	0.23	0 of 3	0.43 - 0.44	-	(0.410)
Dibenzofuran	(0.590)	2 of 3	1.1	0.11 - 0.3	0 of 3	0.43 - 0.44	-	(0.410)
Fluoranthene	0.720	3 of 3	-	0.93 - 1.6	2 of 3	0.43	0.068 - 0.27	1.300
Fluorene	(0.590)	1 of 3	0.55 - 1.1	0.12	0 of 3	0.43 - 0.44	-	(0.410)
Indeno(1,2,3-cd)pyrene	0.260	3 of 3	-	0.38 - 1.1	0 of 3	0.43 - 0.44	-	(0.410)
Naphthalene	(0.590)	2 of 3	1.1	0.11 - 0.4	0 of 3	0.43 - 0.44	-	(0.410)
Phenanthrene	0.290	3 of 3	-	0.61 - 1.6	1 of 3	0.43 - 0.44	0.094	0.330
Pyrene	0.680	3 of 3	-	0.1 - 1.6	1 of 3	0.43	0.098	1.200

Table 3-3
Comparison of Upgradient and Downgradient Samples: Chemicals Detected in Surface Soil from Drainages at the Recticon and Allied Steel Facilities

Chemical (Units in mg/kg)	Allied Steel				Recticon			
	UPGRADIENT Detected Values	Frequency of Detection	DOWNGRADIENT Range of Detection Limits*	Range of Detected Values	Frequency of Detection	UPGRADIENT Range of Detection Limits*	Range of Detected Values	DOWNGRADIENT Detected Values
SVOCs								
Benzoic Acid	(2.800)	1 of 3	2.7 - 5.6	0.26	1 of 3	2.1	0.25	(2.000)
bis(2-ethylhexyl)phthalate	0.260	3 of 3	-	0.22 - 0.93	2 of 3	0.43	0.046 - 0.072	0.560
Butylbenzylphthalate	0.140	2 of 3	0.95	0.17 - 0.39	0 of 3	0.43 - 0.44	-	0.092
Di-n-butylphthalate	(0.590)	1 of 3	0.95 - 1.1	0.073	0 of 3	0.43 - 0.44	-	0.099
VOCs								
Acetone	(0.018)	1 of 3	0.014 - 0.033	0.025	1 of 3	0.013	0.018	0.140
Trichloroethene	0.002	1 of 3	0.007 - 0.009	0.005	0 of 3	0.006 - 0.007	-	(0.006)

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Notes:
Allied Steel upgradient and Recticon downgradient were only sampled once each.
Sample quantitation limits for nondetected values are shown in parentheses.
Samples collected downgradient of the Allied Steel facility are also downgradient of the Recticon facility.

Table 3-4
Summary Statistics for Soil Vapor Samples at the Recticon and Allied Steel Facilities

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Arithmetic Average	Standard Standard Deviation	95% UCL of Arithmetic Average
Recticon - Unpaved Areas (a)						
Carbon Tetrachloride	20 of 36	0.00009 - 0.001	0.0002 - 0.001	0.0003	0.0003	0.0004
Chloroform	3 of 36	0.001 - 0.01	0.003 - 0.007	0.0010	0.0016	0.0015
Tetrachloroethene	11 of 36	0.0002	0.0003 - 0.004	0.0004	0.0007	0.0006
Toluene	6 of 36	0.1 - 0.6	1.0 - 2.0	0.3042	0.4303	0.4754
TPHC	2 of 36	0.4 - 1.0	2.0 - 4.0	0.4986	0.6708	0.6883
Trichloroethane	34 of 36	0.0005	0.0006 - 0.06	0.0054	0.0112	0.0086
Trichloroethene	21 of 36	0.0008 - 0.001	0.0009 - 6.0	0.2939	1.0500	0.5909
Recticon - Paved Areas (b)						
Carbon Tetrachloride	5 of 16	0.00009 - 0.01	0.0002 - 0.03	0.0972	0.2462	0.2051
Chloroform	5 of 16	0.001 - 0.1	0.002 - 0.07	0.0040	0.0086	0.0077
Tetrachloroethene	9 of 16	0.0002 - 0.02	0.001 - 0.03	0.0056	0.0083	0.0092
Toluene	3 of 16	0.1 - 18.0	0.3 - 1.0	0.8422	2.3381	1.8669
TPHC	9 of 16	0.4 - 1.0	2.0 - 990.0	1.0031	2.3019	2.0119
Trichloroethane	15 of 16	0.05	0.0007 - 1.0	0.2594	0.1486	0.3245
Trichloroethene	12 of 16	0.0008 - 0.001	0.007 - 170	0.4000	0.1183	0.4519
Allied Steel (c)						
Benzene	3 of 51	0.05 - 2	0.2 - 2.0	0.1377	0.3125	0.2109
Carbon Tetrachloride	31 of 48	0.00005 - 0.001	0.00007 - 0.002	0.0004	0.0004	0.0005
Chloroform	3 of 52	0.0005 - 0.02	0.0035 - 0.029	0.0019	0.0045	0.0029
Ethylbenzene	1 of 51	0.2 - 3.0	0.7	0.3059	0.3792	0.3946
Tetrachloroethene	12 of 52	0.0001 - 0.002	0.0003 - 3.0	0.0625	0.4163	0.1590
Toluene	6 of 51	0.1 - 1.0	0.8 - 10.0	0.6500	1.7369	1.0564
TPHC	16 of 51	0.3 - 3.0	1.0 - 40.0	4.1412	9.0120	6.2499
Trichloroethane	43 of 49	0.0005 - 0.003	0.0004 - 0.2	0.0103	0.0322	0.0180
Trichloroethene	26 of 52	0.0001 - 0.03	0.001 - 0.8	0.0537	0.1430	0.0868
Xylene	4 of 51	0.3 - 11.0	1.5 - 20.0	1.3980	3.2238	2.1524

Data from RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Note: Summary statistics were calculated by replacing nondetected values with one-half the sample quantitation limit.

(a) Based on samples collected in unpaved areas of the Recticon facility:

RA1-4'	RC9-3'	RF11-3'	RG1-3'	RI1-5'	RL1-3'
RB13-5'	RD1-4'	RF13A-3'	RH1-3'	RJ1-2'	RL11-4'
RC1-4'	RD11-3'	RF13B-3'	RH13-2'	RJ11-4'	RL13-2'
RC3-4'	RD13-5'	RF13C-1.5'	RH15-3.5'	RJ15-4'	RL15-3'
RC5-2.5'	RD9-3'	RF15-4'	RH7-2'	RJ7-2'	RL8-3'
RC7-3'	RE13-6'	RF9-3'	RH9-3'	RJ9-2'	RL9-2'

Please see table A-4 for individual analytical results.

(b) Based on samples collected in paved areas of the Recticon facility:

RA3-3'	RA7A-6'	RH3-4'	RL2-3'
RA5-2'	RA9-3'	RH5-6'	RL3-5'
RA6A-3'	RB11-5'	RJ3-4'	RL5-5'
RA7-3'	RG2-3'	RJ5-5'	RL6-3'

Please see table A-4 for individual analytical results.

(c) Based on all samples collected from the Allied Steel facility:
Please see table A-4 for individual analytical results.

Table 3-5
Summary of Chemicals Detected in Subsurface Soil Samples at the Recticon and Allied Steel Facilities

Chemical	Allied Steel			Recticon		
	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations
METALS (in mg/kg)						
Aluminum	6 of 6	-	4040 - 8200	6 of 6	-	2290 - 9440
Arsenic	6 of 6	-	1.2 - 2.7	3 of 6	0.45 - 0.46	0.81 - 2.2
Barium	6 of 6	-	32.2 - 106	6 of 6	-	38.3 - 317
Beryllium	3 of 6	0.44 - 0.49	0.48 - 0.59	4 of 6	0.43 - 0.46	0.71 - 1.3
Chromium	6 of 6	-	12.4 - 21.7	6 of 6	-	2.6 - 16.5
Cobalt	6 of 6	-	5.9 - 15.7	6 of 6	-	4.7 - 15.1
Copper	6 of 6	-	9.7 - 22.4	5 of 6	2.3	2.6 - 16.3
Lead	6 of 6	-	5.3 - 15.3	6 of 6	-	1.1 - 15.7
Manganese	6 of 6	-	330 - 1000	6 of 6	-	270 - 1450
Nickel	6 of 6	-	7.3 - 13.2	6 of 6	-	3.3 - 31.7
Vanadium	6 of 6	-	14 - 23.2	6 of 6	-	4.1 - 22.2
Zinc	6 of 6	-	21.8 - 36	6 of 6	-	6.4 - 46.9
SVOCs (in ug/kg)						
Benzoic Acid	4 of 6	1600 - 2000	49 - 120	1 of 6	1700 - 1900	99
bis(2-ethylhexyl)phthalate	1 of 6	330 - 450	62	0 of 6	350 - 420	-
Di-n-butylphthalate	0 of 6	330 - 450	-	1 of 6	350 - 420	160
VOCs (in ug/kg)						
1,2-Dichloroethene (total)	0 of 7	5 - 10	-	1 of 6	5 - 6	48
Acetone	0 of 7	11 - 20	-	4 of 6	11 - 13	9 - 114
Methylene Chloride	1 of 7	5 - 10	1	2 of 6	5 - 6	3
Trichloroethene	1 of 7	5 - 10	2	3 of 6	5 - 6	7 - 400

Data summarized from Table 4-5 of RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Table 3-6
Summary Statistics for Bedrock Monitoring Well Samples at the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Arithmetic Average	Standard Deviation	95% UCL of of Arithmetic Average
METALS (total)						
Aluminum	8 of 8	-	80.4 - 2290	523.55	729.11	1012.12
Arsenic	2 of 8	2	2.1 - 2.4	1.31	0.58	1.70
Barium	8 of 8	-	119 - 361	253.63	75.33	304.10
Beryllium	1 of 8	1	1.2	0.59	0.25	0.75
Chromium	3 of 8	6	6.4 - 6.7	4.31	1.81	5.53
Cobalt	6 of 8	4	4.3 - 9.1	5.68	2.72	7.50
Copper	8 of 8	-	7.3 - 10.8	9.34	1.37	10.26
Manganese	8 of 8	-	205 - 1420	557.25	392.58	820.31
Nickel	7 of 8	7	8.1 - 19.7	10.80	4.96	14.12
Vanadium	1 of 8	4	8	2.75	2.12	4.17
METALS (dissolved)						
Antimony	1 of 8	16	19.1	9.39	3.92	12.02
Barium	8 of 8	-	20 - 318	194.25	95.07	257.95
Cobalt	1 of 8	4	4.6	2.33	0.92	2.94
Copper	3 of 8	10	10.1 - 12.9	7.29	3.27	9.48
Lead	1 of 8	1	4.5	1.00	1.41	1.95
Manganese	8 of 8	-	159 - 1200	470.25	352.85	706.69
Nickel	6 of 8	7	7 - 15.1	8.51	3.86	11.10
Zinc	8 of 8	-	27.8 - 56.7	13.54	21.48	27.94
SVOCs						
Dimethylphthalate	1 of 8	10	2	4.63	1.06	5.34
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethane	1 of 1	-	3	-	-	-
Carbon Disulfide	9 of 9	-	0.08 - 560	-	-	-
tert-butylmethylether	7 of 7	-	0.25 -1.5	-	-	-
VOCs						
1,1,1-Trichloroethane	21 of 32	0.5 - 50	0.1 - 2.5	0.97	0.85	1.54
1,1,2-Trichloroethane	1 of 32	0.5 - 50	0.3	0.25	0.00	0.25
1,1-Dichloroethane	18 of 32	0.5 - 50	0.12 - 2.7	1.02	0.93	1.65
1,1-Dichloroethene	10 of 32	0.5 - 50	0.08 - 2.9	0.99	1.07	1.71
1,2,3-Trichlorobenzene	1 of 32	0.5 - 50	0.19	0.25	0.01	0.25
1,2,4-Trimethylbenzene	1 of 32	0.5 - 50	0.05	0.24	0.02	0.26

Table 3-6
Summary Statistics for Bedrock Monitoring Well Samples at the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Arithmetic Average	Standard Deviation	95% UCL of of Arithmetic Average
1,2-Dichloroethane	5 of 32	0.5 - 50	0.52 - 2.6	0.49	0.61	0.90
cis-1,2-Dichloroethene	27 of 32	0.5	0.38 - 730	221.38	287.16	413.81
trans-1,2-Dichloroethene	8 of 32	0.5 - 50	0.24 - 8.4	0.86	1.50	1.87
1,3-Dichlorobenzene	2 of 32	0.5 - 50	0.05 - 0.07	0.24	0.02	0.25
Benzene	7 of 32	0.5 - 50	0.08 - 0.36	0.23	0.03	0.25
Carbon Tetrachloride	1 of 32	0.5 - 50	0.93	0.27	0.06	0.31
Chlorobenzene	1 of 32	0.5 - 50	0.19	0.25	0.01	0.25
Chloroethane	6 of 32	0.5 - 50	0.18 - 0.47	0.28	0.07	0.33
Chloroform	17 of 32	0.5 - 50	0.06 - 1.3	0.25	0.11	0.33
Chloromethane	1 of 32	0.5 - 50	1	0.28	0.09	0.34
Dichlorodifluoromethane	6 of 32	0.5 - 50	0.14 - 0.84	0.31	0.11	0.38
Methylene Chloride	17 of 32	0.5 - 50	0.15 - 14	0.18	0.02	0.20
Tetrachloroethene	11 of 32	0.5 - 50	0.11 - 8.8	1.48	2.57	3.20
Trichloroethene	31 of 32	0.5	0.3 - 1900	627.26	648.65	1061.91
Trichlorofluoromethane	3 of 32	0.5 - 50	0.06 - 7.5	0.27	0.06	0.31
Vinyl Chloride	9 of 32	0.5 - 50	0.42 - 2.2	0.56	0.37	0.81
m,p-Xylene	1 of 32	0.5 - 50	0.07	0.24	0.02	0.26

Data are summarized from RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Notes:

(1) Average and UCL concentrations for VOCs were calculated based on the average concentration detected over time in each well. SVOCs and metals were tested in only one sampling event.

(2) To calculate summary statistics, nondetected concentrations were assumed to be one-half the sample quantitation limit. However, nondetected results were excluded from the calculation in cases where the sample quantitation limit exceeded the maximum detected concentration for the well.

Table 3-7
Summary Statistics for Overburden Monitoring Well Samples at the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Arithmetic Average	Standard Deviation	95% UCL of of Arithmetic Average
METALS (total)						
Aluminum	8 of 8	-	1520 - 16600	4825.00	5173.41	8291.62
Arsenic	2 of 8	2	3 - 3.8	1.60	1.13	2.36
Barium	8 of 8	-	40.2 - 250	141.85	70.15	188.86
Beryllium	6 of 8	1	1.2 - 2.8	1.44	0.79	1.97
Chromium	5 of 8	6	7.6 - 37.9	15.00	13.18	23.83
Cobalt	6 of 8	4	5.9 - 112	23.04	36.77	47.68
Copper	8 of 8	-	6.8 - 27.6	13.58	7.16	18.37
Manganese	8 of 8	-	128 - 3750	1122.63	1138.49	1885.51
Nickel	8 of 8	-	14.2 - 60	28.10	15.95	38.79
Vanadium	4 of 8	4	6.5 - 35.2	11.16	13.13	19.96
METALS (dissolved)						
Aluminum	1 of 8	26	671	95.25	232.64	251.14
Antimony	2 of 8	16	16 - 17.5	10.19	4.07	12.91
Barium	8 of 8	-	27.5 - 117	60.84	28.64	80.03
Beryllium	1 of 8	1	2.4	0.74	0.67	1.19
Chromium	1 of 8	6	6.1	3.39	1.10	4.12
Cobalt	3 of 8	4	4 - 84.9	14.94	28.99	34.36
Copper	6 of 8	10	11.7 - 18.4	12.51	5.17	15.98
Manganese	8 of 8	-	53.5 - 2960	711.81	992.35	1376.77
Nickel	5 of 8	7	9.3 - 32.5	13.18	11.68	21.00
Selenium	1 of 8	2	2.1	1.14	0.39	1.40
Zinc	8 of 8	-	15.5 - 55.9	17.42	32.44	39.16
SVOCs						
bis(2-ethylhexyl)phthalate	5 of 8	10	1.0 - 22.0	5.38	6.95	10.03
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethane	1 of 1	-	2	-	-	-
tert-butylmethylether	2 of 2	-	0.72 - 1.2	-	-	-
VOCs						
1,1,1-Trichloroethane	17 of 27	0.5	0.05 - 7.3	0.89	1.01	1.57
1,1-Dichloroethane	15 of 27	0.5	0.09 - 16	1.53	1.95	2.83
1,1-Dichloroethene	5 of 27	0.5 - 5	0.15 - 0.77	0.28	0.08	0.33
1,2-Dichloroethane	11 of 27	0.5 - 5	0.18 - 5	1.42	1.69	2.55

Table 3-7
Summary Statistics for Overburden Monitoring Well Samples at the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits*	Range of Detected Concentrations	Arithmetic Average	Standard Deviation	95% UCL of of Arithmetic Average
cis-1,2-Dichloroethene	21 of 27	0.5	0.11 - 190	24.12	35.69	48.04
trans-1,2-Dichloroethene	6 of 27	0.5 - 5	0.13 - 0.34	0.25	0.01	0.25
Benzene	2 of 27	0.5 - 5	0.12	0.26	0.05	0.29
Chloroethane	1 of 27	0.5 - 5	0.37	0.26	0.01	0.26
Chloroform	5 of 27	0.5 - 5	0.06 - 0.8	0.22	0.04	0.25
Methylene Chloride	15 of 27	0.5 - 5	0.11 - 2.2	0.30	0.17	0.41
Tetrachloroethene	14 of 27	0.5 - 5	0.07 - 17	2.71	5.35	6.29
Toluene	6 of 27	0.5 - 5	0.06 - 0.25	0.19	0.07	0.23
Trichloroethene	26 of 27	0.5	0.17 - 1200	137.19	179.13	257.22
Trichlorofluoromethane	2 of 27	0.5 - 5	0.06 - 0.09	0.24	0.02	0.25
m,p-Xylene	2 of 27	0.5 - 5	0.08 - 0.11	0.24	0.02	0.25

Data are summarized from RI (Dames & Moore, 1992). See Attachment A for individual sample results.

*Range of sample quantitation limits is shown for samples that did not contain detectable concentrations.

Notes:

(1) Average and UCL concentrations for VOCs were calculated based on the average concentration detected over time in each well. SVOCs and metals were tested in only one sampling event.

(2) To calculate summary statistics, nondetected concentrations were assumed to be one-half the sample quantitation limit. However, nondetected results were excluded from the calculation in cases where the sample quantitation limit exceeded the maximum detected concentration for the well.

Table 3-8
Summary of Chemicals Detected in Business/Residential Water Supplies Offsite in the Vicinity of the Recticon/Allied Steel Site

Chemical (Units in ug/l)	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	Sampling Station
VOCs				
1,1,1-Trichloroethane	5 of 49	1 - 5	1 - 4	3A (2), 17A (2), 26A
Methylene Chloride	6 of 49	1 - 5	1 - 2	3A, 4A, 7A, 23B, 27A, 29A
Toluene	2 of 49	1 - 5	5 - 6	25A (2)
Trichloroethene	6 of 49	1 - 5	1	2A (2), 4A (2), 16A, 17A

(2) indicates that the chemical was detected in a particular well during two different sampling periods.

Note: Samples were collected at the tap during semi-annual monitoring of water supplies which are near the Recticon/Allied Steel Site but are not treated by carbon filtration.

Data are summarized from Table 4-22 of the RI (Dames & Moore, 1992). See Attachment A for individual sample results.

4.0 EXPOSURE ASSESSMENT

Exposure is the contact of an individual with a chemical. Exposure assessment consists of the estimation of the magnitude, frequency, duration, and routes of exposure of a chemical to a receptor. Human exposure to chemicals is typically evaluated by estimating the amount of chemical intake upon chemical contact with the lungs, gastrointestinal tract, or skin during a specified period of time. Chemical intakes and associated risks are quantified for all exposure pathways considered to be complete. The exposure assessment involves the following steps:

- Identification of potentially exposed populations and exposure scenarios;
- Identification of potential exposure pathways and selection of complete exposure pathways;
- Evaluation of the environmental fate and transport of chemicals in soil and groundwater;
- Estimation of exposure point concentrations used to quantify chemical intakes; and
- Quantification of chemical intakes for each exposure pathway.

Estimates of human exposure have been based on a Reasonable Maximum Exposure (RME) scenario. The RME is defined as the highest exposure that is reasonably expected to occur at a site. The overall risk estimate for a site, integrated over multiple pathways and chemicals, is expected to represent a RME scenario (EPA, 1989a). RMEs are estimated for individual exposure pathways. If a population is exposed via more than one pathway, the combination of exposures across pathways must also represent a RME (EPA, 1989a).

4.1 EXPOSURE SCENARIOS

The exposure scenarios for the Recticon/Allied Steel Site are as follows:

Current Land Use

- Onsite trespasser
- Offsite resident

Future Land Use

- Onsite worker
- Onsite resident

Exposure to offsite residents is also possible under future land use, but the exposure pathways and conditions are similar to the current scenario. Therefore, only the current scenario for the offsite resident was quantified. The following subsections describe the rationale for the selection of these exposure scenarios. Attachment C presents site photographs which elucidate the onsite exposure possibilities.

4.1.1 CURRENT LAND USE

The Site is not currently occupied but may be accessible (*i.e.*, no fence surrounds the Site); therefore, a trespasser scenario was evaluated. Exposure to nearby residents was be evaluated.

4.1.2 FUTURE LAND USE

The Site is currently vacant; however, it is likely that future commercial tenants could occupy the property without extensive alterations. Therefore, an onsite worker scenario was evaluated. Although land use at the Site is likely to remain commercial/industrial, an alternative scenario in which the existing onsite facilities are removed and replaced with residences was examined. If this occurs, the onsite worker scenario would be replaced with an onsite residential scenario. Such changes in land use would have an impact on the onsite exposure, but the trespasser (under commercial land use) and offsite residential scenarios would likely remain the same as current exposure. Therefore, the scenarios were only considered in the current scenario, although they may apply for the future scenario as well.

4.2 IDENTIFICATION OF EXPOSURE PATHWAYS

An exposure pathway describes the mechanism through which a chemical comes into contact with a receptor. There must be a complete exposure pathway from the source of chemicals in the environment (*i.e.*, in soil or groundwater) to human receptors in order for chemical intake to occur. In this section, the complete exposure pathways are identified. A complete chemical exposure pathway consists of the following four elements:

- A source of chemical release to the environment;
- An environmental transport medium (*i.e.*, groundwater, soil gas, soil or ambient air);
- A point of contact (known as the exposure point) with the chemicals of concern; and
- A route of intake for the chemical into the receptor (*i.e.*, inhalation, ingestion, or dermal contact).

If one of these four elements is missing, then the exposure pathway is incomplete and there is no intake (or subsequent health risk) associated with that pathway. The presence or absence of any of these elements depends on the specific conditions found at the Site. Exposure pathways were evaluated for particular environmental transport media in the following subsections.

4.2.1 SOIL EXPOSURE PATHWAYS

Chemical releases to surface soil on the Site have been documented through the history of site activities and site investigations. Humans may be directly exposed to surface soils via soil ingestion or dermal contact with exposed soil. The RI notes that waste water was occasionally discharged to surface drainages at the Recticon facility, no other source to surface soil was identified.

Current

For soil pathways to be complete, chemicals in soil must be accessible for human contact. The presence of pavement, buildings, or even an overlying layer of clean soil can prevent or limit contact. As much of the Recticon facility is covered with pavement or buildings, contact with soil is not likely. Much of the Allied Steel facility is unpaved, but no source to exposed soils was identified in the RI. Although both facilities share a drainage ditch that may have received site-related chemicals (the Allied Steel facility is downgradient of the Recticon facility; the trespasser scenario will be evaluated for exposure to soils via ingestion and dermal contact, because it is the only current onsite scenario.

Future

Under the present site layout, future workers are not likely to come into contact with soil from the drainage ditch on a regular basis. However, limited contact will be considered quantitatively.

Although subsurface soil may be brought to the surface due to construction activities, only soil from the first couple of feet are likely to be impacted. Only one significant TCE source area was detected: 1.4 mg/kg TCE at 9 to 11 feet bgs in boring R/A7 from the Recticon facility. 1,2-DCE (total) was detected in the same sample at 0.05 mg/kg. Acetone was detected in a sample from boring R/G2 at 8 to 10 feet bgs, and methylene chloride was found in three samples at a maximum of 0.003 mg/kg.

4.2.2 AIR EXPOSURE PATHWAYS

Air exposure pathways include the inhalation of chemical vapors (in indoor and outdoor air) and the inhalation of contaminated particulates.

Current

Exposure to VOCs at the Site is possible via the inhalation of vapors from chemicals in soil and groundwater. Airborne soil particulates contaminated with chemicals also provide a potential inhalation exposure pathway for onsite populations, although as suggested in the last section, surficial soil

contamination appears to be limited to the drainage ditch area. The trespasser scenario will be evaluated for outdoor exposure to chemical vapors emanating from subsurface sources, and the inhalation of airborne soil particulates. Offsite residents will be evaluated for exposure to chemical vapors emanating from groundwater which may exist under residences near the Site.

Future

Chemicals may also migrate through soil to indoor air. Exposure to chemical vapors from soil and groundwater sources (near existing buildings), and the intake from particulate inhalation will be evaluated for the onsite worker and the potential onsite residential scenarios. Exposure to future offsite residents will be evaluated under the same conditions assumed under the current scenario for exposure to chemical vapors emanating from groundwater.

4.2.3 GROUNDWATER EXPOSURE PATHWAYS

Like subsurface soil, groundwater must also reach the surface, either by mechanical or natural means, before human contact can occur. Once brought to the surface, exposure to chemicals in groundwater can occur through dermal contact, ingestion, or inhalation of vapors during showering.

Current

Offsite residents in the vicinity obtain their water from local wells and could be exposed to chemicals via dermal contact, ingestion, or inhalation. However, Rockwell and USEPA executed an Administrative Order (May 14, 1990), in which Rockwell agreed to perform a Removal Action. As part of the Removal Action, six carbon filtration systems were installed, and 22 residential/business (including the six systems) are routinely monitored. As these systems appear to have been successful in eliminating the chemicals from water, little exposure is likely to occur, as long as monitoring and appropriate responses occur. Therefore, because of treatment, exposure is likely only at relatively low levels. For illustration purposes, the risks associated with ingestion of these low levels will be calculated to provide an upper bound to risk (see Section 6.0).

Future

Well water use is expected to continue under future conditions. Current wells are likely to be maintained, and new ones may be added if the local residential population increases (*e.g.*, if residential units are constructed onsite). Although any new wells in the vicinity of the Site are likely to have filtration and/or routine monitoring, exposures to future onsite workers and residents (assuming no corrective measures) are examined to establish baseline risks. The risks will be quantified for the bedrock aquifer as it is more likely to be used for production than the overburden aquifer. Contamination in both aquifers appears to be roughly comparable. For example, TCE was detected in 31 of 32 samples in the bedrock aquifer at a range of 0.3 - 1,900 μg/L, while this chemical was detected in 26 of 27 samples in the overburden aquifer at a range of 0.17 - 1,200 μg/L. Workers are assumed to ingest water and onsite residents are assumed be exposed to chemicals via dermal contact, ingestion, and inhalation.

4.2.4 SURFACE WATER/SEDIMENT PATHWAYS

The samples collected suggest only background concentrations of inorganic substances, and laboratory contamination by phthalate esters. Although the drainage ditch and certain low-lying areas (*e.g.*, the truck scale pit) periodically fill with water, no permanent surface water bodies exist onsite; therefore, contact with surface water is not considered. Pigeon Creek and Schuylkill River are located approximately 2,000 feet away to the southwest and east, respectively, and are not expected to receive substantial run-off from the Site; therefore, the surface water pathway will not be evaluated.

4.2.5 FOOD CHAIN EXPOSURE PATHWAYS

Food chain exposure can occur through the ingestion of fruits and vegetables which have been cultivated with potentially contaminated soil or groundwater. No edible vegetation is cultivated onsite. Groundwater could potentially affect food grown off of the Site, but this pathway is not likely to be complete because VOCs do not bioaccumulate in tissues (*e.g.*, vegetables and livestock). Therefore, this exposure pathway is not evaluated.

4.2.6 Summary of Selected Exposure Pathways

Table 4-1 summarizes the exposure scenarios and pathways evaluated in the Risk Characterization section.

4.3 Environmental Fate and Transport

4.3.1 Emissions of Volatile Organic Compounds to Air

VOCs can be emitted to the air from either soils or groundwater. Chemical diffusion through soil and volatilization to air is the principal pathway for volatile organic chemical loss from soils, and is a complex process controlled by soil, chemical, and atmospheric processes. In general, chemicals with high Henry's Law constants are more volatile, diffuse more readily through soil and tend to move relatively independently of atmospheric conditions.[2] Factors that limit diffusion, such as increased adsorption to soil and increased soil moisture content, can decrease the amount of volatilization that occurs. Factors that increase volatilization include increased soil temperature and increased chemical concentrations in soil (Jury and Valentine, 1986).

Concentrations of chemicals in air resulting from emissions from underground sources were estimated using relatively simple models. Using the results of onsite samples collected from soil, soil gas, or groundwater, these models provide health-conservative estimates of concentrations in air (*i.e.*, estimates that are higher than would be measured under field conditions). When available, the results of the soil gas survey were used in preference to soil or groundwater samples (because they are likely to include the contribution from chemicals originating in soil or groundwater). The results of soil and/or groundwater samples were used only if a compound was detected in these media but not in soil gas. The steps used to estimate chemical concentrations in air are:

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[2]Henry's Law constant, the ratio of vapor concentration to the aqueous concentration, is an index of the partitioning of a chemical between dissolved and gaseous phases. The larger the value of Henry's constant, the more likely the chemical is to move by vapor diffusion as opposed to liquid diffusion.

1) Compile the results from appropriate subsurface soil, soil gas, and groundwater samples from RI data;

2) Estimate soil gas concentrations from each medium;

3) Estimate steady-state emission rates (using the Farmer *et al.* (1980) emission model) and select:

   - The emission rate based on soil gas samples; or
   - The sum of emission rates based on subsurface soil and overburden (upper) aquifer samples;

4) Calculate chemical concentrations in air (based on selected emission rate):

   - Use the "box model" to estimate outdoor air concentrations for the scenarios considered;
   - Use an indoor air model to estimate indoor air concentrations.

These steps are described in detail in the following subsections. The calculations performed for the estimation of air concentrations are shown in Attachment D.

Step 1: Compile appropriate sample concentrations from data

The results of subsurface soil, soil gas, and groundwater samples could be used as initial concentrations for the air models. The selection of initial concentrations will depend on the availability of data, and the exposure scenario. Therefore, samples from different areas at both facilities were examined to assess onsite scenarios:

- Paved areas of the Recticon facility;
- Unpaved areas of the Recticon facility;
- The Allied Steel facility; and
- The areas near buildings (at both the Allied Steel and Recticon facilities).

On the Recticon facility, unpaved areas represent outdoor exposure under the current scenarios and paved areas represent outdoor exposure if the Site is redeveloped (as under the future onsite residential scenario). Samples from all areas of the Allied Steel facility were used to develop emission rates in all cases except when determining the maximum concentrations from near-building sources. The concentrations detected near the buildings (on both facilities) represent potential sources of chemicals that may enter existing buildings and circulate in indoor air. For offsite exposure, the only potentially significant source from site-related media to air is the migration of chemicals from groundwater.

The different representative concentrations used in the modeling (by facility, medium, and scenario), are presented in Table 4-2. Except for the maximums near buildings, all concentrations were compiled from the data in Section 3.0. Two of the VOCs that were detected in the subsurface soil, 1,2-DCE and acetone, were not tested in the soil vapor survey. Therefore, the soil boring data and groundwater (overburden) data (95% UCLs) were used as model inputs to estimate soil vapor concentrations for 1,2-DCE and acetone. To determine the maximum concentrations near the buildings, all samples within 10 feet of the buildings were identified with soil gas samples being used in preference to subsurface soil or groundwater samples (soil and groundwater samples were used if no detectable amounts were found in soil gas samples). The maximum chemical concentrations are shown in Table 4-3.

Step 2: Estimate Soil Gas Concentrations

For each of the media sampled, a different calculation procedure is used to estimate the soil gas concentration. Each of these is discussed below.

Soil Samples

If it is assumed that changes in soil and vapor phase concentrations occur slowly, it can be assumed that vapor phase concentrations and soil concentrations are in local equilibrium. If the concentrations in soil and interstitial vapors approach equilibrium, they are related by the following equation (EPA, 1988b):

$$C_v = C_s \times \left(\frac{H}{RT \times K_d} \right) \times CF \qquad (1)$$

where,

C_v	=	Concentration of chemical in vapor phase in soil pores (mg/m^3)
C_s	=	Concentration of chemical in soil (mg/kg)
H	=	Henry's constant (atm m^3/mol)
R	=	Universal gas law (atm m^3/mol K)
T	=	Temperature (K)
K_d	=	Soil/water partition coefficient (ml/g)
CF	=	Conversion factor (10^{-3} kg/g)(10^6 ml/m^3)

The C_s, H and K_d parameters are all chemical-specific; the other factors will remain constant. C_s is based on the maximum concentration detected in onsite soils. H and K_d, along with all other physical/chemical properties used in this section, are presented in Table 4-4, . The soil/water partition coefficient (K_d) is an important determinant in the migration of chemicals. Since K_d values (also referred to as the soil distribution factor) are not available for all chemicals, they must be estimated. EPA (1988b) suggests that K_d values can be estimated by multiplying the Organic Carbon Partition Coefficient (K_{oc}) by the fraction of organic carbon in soil (f_{oc}):

$$K_d = K_{oc} \times f_{oc} \qquad (3)$$

where,

K_d	=	Soil/water partition coefficient (ml/g)
K_{oc}	=	Organic carbon partition coefficient (ml/g)
f_{oc}	=	Fraction of organic carbon in soil

Since the amount of organic carbon in soil can vary between soil types, as well as individual samples of like soils, f_{oc} was assumed to be 0.0158. This represents the median value of the range of f_{oc} values (0.0011 to 0.0304) reported by Karickhoff (1984).

Groundwater Samples

The estimation of partitioning of chemicals in groundwater to soil gas involved a two-step process. First, Henry's Law was used to express the partitioning between concentrations of chemicals dissolved in groundwater and concentrations (at equilibrium) in the overlying soil gas as follows:

$$P = \left(\frac{H \times C_W}{MW}\right) \times CF \qquad (4)$$

where,

P	=	Partial pressure of the chemical in soil gas (atm)
H	=	Henry's Law Constant (atm m^3/mol)
C_w	=	Chemical concentration dissolved in water (mg/L)
MW	=	Molecular weight of chemical (g/mol)
CF	=	Conversion factor (10^{-3} g/mg)(10^3 L/m^3)

The 95% UCL concentrations from overburden aquifer samples were used for C_w. Table 4-4 lists the physical/chemical parameters including values for P, H, and MW used in this calculation.

In the second step, the partial pressure of the chemical in soil gas was converted to a concentration using the Ideal Gas Law:

$$C_v = \left(\frac{P \times MW}{RT}\right) \times CF \qquad (5)$$

where,

C_v	=	Chemical concentration in soil gas (mg/m^3)
P	=	Partial pressure in soil gas (atm)
MW	=	Molecular weight of chemical (g/mol)
R	=	Ideal gas constant (8.21^{-5} atm m^3/mol K)
T	=	Temperature (283 K)
CF	=	Conversion factor (10^3 mg/g)

Soil Gas Samples

A soil gas survey was conducted at the Site. As the results of this survey reported chemical concentration in terms of soil gas concentrations, their values were used directly in the emissions model after converting these measured concentrations from units of ($\mu g/L$) to (mg/m^3).

Step 3: Estimate Emission Rates

VOC emissions for each of the three media were estimated using the covered-landfill emission model developed by Farmer *et al.* (1980). This steady state model is also cited in the Superfund Exposure Assessment Manual (EPA, 1988b). The model is used to predict emissions from a covered landfill based on Fick's First Law of diffusion and accounts for many of the factors that influence chemical migration such as soil temperature, chemical concentrations, Henry's Law constants, soil moisture content, and chemical adsorption to soil. Diffusion of chemicals to the soil surface is described by diffusion relationships developed by Millington and Quirk (1961). Emission rates for soil, soil gas, and groundwater were calculated separately as follows:

$$Q = D \times \left(\frac{P_A^{10/3}}{P_T^2}\right)\left(\frac{C_v}{L}\right) \times CF \qquad (6)$$

where,

Q	=	Emission rate ($mg/m^2/s$)
D	=	Diffusion rate of the chemical in air (cm^2/s)
P_A	=	Air-filled soil porosity (dimensionless)
P_T	=	Total soil porosity (dimensionless)
C_v	=	Concentration of the chemical as soil gas at depth L (mg/m^3)
L	=	Depth of soil cover (m)
CF	=	Conversion factor (10^{-4} m^2/cm^2)

The diffusion rates (D) in air for several of the VOCs were obtained from Shen, 1981. For chemicals without tabulated diffusion rates, the diffusion rate was calculated using Fuller's method, described in Perry and Chilton (1973), and also referred to in the Superfund Exposure Assessment Manual (EPA, 1988b) (see box below).

Fuller's Method
(Perry and Chilton, 1973)

$$D = \frac{0.001T^{1.75}\sqrt{\frac{1}{MW_i} + \frac{1}{MW_a}}}{P_a[(\Sigma V_i)^{1/3} + (\Sigma V_a)^{1/3}]^2} \quad (7)$$

where,

D	=	Diffusion rate in air (cm^2/s)
T	=	Temperature in soil gas (K)
MW_i	=	Molecular weight of chemical *i* (g/mol)
MW_a	=	Molecular weight of air (28.8 g/mol)
P_a	=	Atmospheric pressure (atm)
ΣV^i	=	Molecular diffusion volume of chemical *i* (cm^3/mol)
ΣV_a	=	Molecular diffusion volume of air (20.1 cm^3/mol)

The molecular diffusion volumes used in estimating D were obtained from Perry and Chilton, 1973 (as cited in EPA, 1988b):

C = 16.5	CL = 19.5
H = 1.98	BR = 35.0
O = 5.48	F = 25.0
N = 5.69	S = 17.0
AROMATIC RING = -20.2	HETEROCYCLIC RING = -20.2

The diffusion coefficients used in Equation 6 for each chemical are presented in Table 4-4. The parameters for total porosity, air-filled porosity, and depth of chemical source that are used in Equation 6 are discussed below.

Total soil porosity (P_T) is the space in soil not occupied by soil particles. These spaces are occupied by either vapor or water and allow for the travel of chemical substances. According to the Phase I RI (Dames & Moore, 1992), soils in the study area are comprised primarily of silty clay to a depth approximately 25 to 35 feet bgs. From this information, the total porosity for site soils was

assumed to be 0.588 which is the default value for a silty clay loam (USDA soil texture class SICL) as shown in the Hydrogeologic Evaluation of Landfill Performance (HELP) Model (EPA, 1983).

The air-filled soil porosity (P_A) is that portion of the total soil porosity not occupied by water. Water in soil pores impedes the travel of volatile compounds to the surface. P_A accounts for the effect of soil moisture on chemical vapor migration, and can be calculated as follows:

$$P_A = P_T - W \quad (8)$$

where,

P_A = Air-filled soil porosity (unitless)
W = Volumetric water content of soil (vol/vol)
P_T = Total soil porosity (unitless)

Based on the boring log data presented in the Phase I RI, site soils tend to be moist. From these data, the volumetric water content (W) of site soils was assumed to be 0.25. This value is approximately one-half the field capacity of a silty clay loam (EPA, 1983).

Soil parameters P_A, P_T, and W (as summarized in the table below) were assumed to be similar for all areas at both the Allied Steel and Recticon facilities. This assumption introduces some uncertainty, as soil conditions are likely to change with depth and location.

Parameter	Allied Steel	Recticon	Source
Total Porosity (P_T)	0.588	0.588	Default Value
Volumetric Water Content of Soil (W)	0.25	0.25	Default Value
Air-filled Porosity (P_A)	0.338	0.338	Calculated (EQ 6)

The depth of soil cover will depend on the depth of the originating source. The assumed depth of soil cover for all sources for both the Recticon and Allied Steel facilities is summarized in the table below.

Facility	Sample Depth bgs (feet)		
	Subsurface Soil	Soil Gas	Groundwater
Allied	12	3.5	32
Recticon	13	3.0	32

- For soil, and soil gas sources, sample depth was based on the sampling data presented in Tables A-4 (soil gas) and A-6 (subsurface soil).
- For groundwater sources, the groundwater elevation maps in the RI were used to estimate the depth to water. The value listed above represents the most shallow depth encountered over both facilities.

From the parameters and equations shown above, emission rates (Q) were calculated for chemicals detected in soil, soil gas, and groundwater samples. The emission rates estimated from soil gas samples were used in preference to soil- or groundwater-based estimates. If soil gas-based emission rates were not available, then the sum of soil and groundwater based emission rates were used to calculate chemical concentrations in air. The selected or summed emissions rates were then used in Step 3.

Step 3: Calculate Chemical Concentrations in Air

Outdoor Air

Chemical concentrations in air from emissions from an area source are expected to be highest at the source, and decrease with distance from the source. A screening-level approach for evaluating concentrations in air from VOC emissions involves calculating concentrations in air over the source area. Air dispersion models (such as ISCST) are not designed to calculate concentrations in air over an area source. However, EPA has recommended use of a "box model" (EPA, 1986f) for calculating concentrations in on-site air:

$$C_a = \frac{Q \times A}{L \times V \times H} \qquad (9)$$

where,

C_a = Concentration in air (mg/m^3)
Q = Emission rate ($mg/m^2/s$)
A = Surface area of the source area (m^2)
L = Width of the surface area perpendicular to the wind direction (m).
V = Average windspeed within the mixing zone, assumed to be 0.5 the windspeed at the mixing height (m/s)
H = Mixing height (m)

The values selected for this model were as follows:

- The values of Q for the chemicals of concern were calculated in the last step;
- The area of emission (A) was assumed to be 100 m^2;
- The value of H represents the breathing zone of an individual (2 m);
- The value of V was 2.13 m/s which is based on the annual average windspeed of 4.25 m/s measured at the Philadelphia International Airport (personal communications, NWS, 1992); and
- The value of L was 10 m, the square root of the surface area.

Indoor Air

The chemical concentrations in indoor air may be estimated from the equation:

$$C_A = \frac{Q \times V_n}{A_b} \qquad (10)$$

where,

C_A	=	Vapor concentration in air (g/m^3)
Q	=	Emission rate (g/m^2-s)
V_n	=	Building ventilation rate (m^3/s)
A_b	=	Emission area (m^2)

The selection of values for this model was as follows:

- The ventilation rate (V_n) is based on standards recommended by the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE, 1989) for general living areas (30 cfm, or 1.4×10^{-2} m^3/s). A higher ventilation rate or open windows or doors will result in higher air turnover and lower chemical vapor concentrations indoors.

- Volatile chemicals may enter a building through openings in the floor (cracks, floor-wall joints, loose-fitting pipes, etc.) or by diffusion through the floor. The ratio of leakage area to total floor area is 1-10 cm^2 per m^2 of floor area (Grimsrud *et al.*, 1983; value is for an average California home). The area of emission (A_b) was calculated as the product of the assumed area (1,076 ft^2 or 100 m^2) and an assumed leakage area of 1 cm^2/m^2. The product of these areas is 0.01 m^2. Diffusion through concrete is likely to be insignificant compared to the amount of chemical infiltrating through building cracks. Concentrations in air are assumed to be steady-state.

4.3.2 Emissions of Volatile Organic Compounds from Water (during Showering)

A recent study evaluated showers as a source of indoor exposure to VOCs (Jo *et al.*, 1990). In this study, the risks associated with a single, 10-minute shower each day with a chloroform concentration of 24.5 μg/L in water were compared with ingestion of 2 L/day of water. The risks from these pathways were as follows:

- Inhalation (shower) - 62 in one million;
- Dermal exposure (shower) - 60 in one million; and
- Ingestion (2 L/day) - 180 in one million.

RAGS presents an equation for estimating inhalation exposures to vapors (Exhibit 6-16, EPA 1989a) and suggests some specific values for inhalation rate and duration of exposure while showering. However, this equation requires estimates of the airborne concentrations within the shower and bathroom. The EPA Risk Assessment Forum has devised a generic model in a draft guidance on this subject. This model assumes that the dose from inhalation of VOCs while showering is approximately equivalent to the dose from ingestion of 2 L/day of the same water (EPA, 1989b). Therefore, the dose from showering was assumed to be equivalent to the dose from ingestion of groundwater. Inhalation slope factors were used to estimate the increased cancer risks associated with exposure to VOC emissions during showering.

4.3.3 Suspension of Wind-blown Dust

Most of the historical research investigating wind-blown dust has been oriented toward the study of erosion losses from agricultural soils (for example, Chepil, 1945a; Chepil, 1945b). Three general modes of particle movement have been identified during these studies: surface creep, saltation and suspension. Surface creep typically involves the largest particles (> 1,000 μm) and only results in movement of several meters by rolling or sliding along the surface. Saltation usually affects the middle size range of particles (550 to 1,000 μm) and refers to short particle trajectories near the surface. Particles moving by saltation usually migrate only short distances during an eroding event, but are responsible for the production of fine particulates through a "sandblasting" effect (Gillette *et al.*, 1974). Suspended particles from agricultural fields were observed to be generally less than 50 μm (Chepil,

1957). Most eroding soil moved only short distances by saltation or surface creep unless the terrain was virtually free of features that obstructed or trapped particles or where the wind velocity exceeded the erosion threshold for long periods of time (Gillette, 1976).

Several models have been developed for estimating emissions of wind-blown dust (several of these models are reviewed in Smith *et al.* (1982)). However, chemicals have been detected only in limited portions of the Site. A screening-level approach was used to determine if emissions estimation and dispersion modeling were required to evaluate exposures through this pathway. This approach involved the following assumptions: the particulate matter in air finer than 10 μm in diameter (PM_{10}) measured in air originates from wind-blown dust from the soil surface and, 2) that all of the dust emitted into the air originates from surface soils with chemical residues. With these two assumptions, a simple calculation can be made of the airborne concentration of chemicals in the particle phase:

$$C_a = PM_{10} \times C_s \times CF \qquad (11)$$

where,

C_a	=	Concentration in air in mg/m^3
C_s	=	Concentration in surface soil in mg/kg
PM_{10}	=	Particulate matter less than 10 microns in diameter (μg/m^3)
CF	=	Conversion factor (10^{-9} kg/μg)

PM_{10} measurements from the Norristown, PA air monitoring station in were used in estimating chemical concentrations in wind-blown dust. The annual average (arithmetic mean) PM_{10} concentration in air for 1991 was 27 μg/m^3 (0.027 mg/m^3). The arithmetic mean and UCL concentrations in soil were combined with the PM_{10} concentration to estimate exposure concentrations for chemicals in soil (see Section 4.4).

4.3.4 CHEMICAL MIGRATION IN GROUNDWATER

Groundwater modeling was not performed on the Site since the local wells are frequently monitored. Some migration has evidently occurred and the concentrations noted in the monitoring program will be used in this assessment.

4.4 ESTIMATION OF EXPOSURE POINT CONCENTRATIONS

This section discusses the selection of exposure concentrations. Exposure concentrations are concentrations in environmental media (*e.g.*, soil or groundwater) used to calculate chemical intakes in humans. Exposure concentrations were selected based on the site-specific scenarios described previously, and site analytical data or modeling results. The sections below describe the selection of exposure point concentrations. Table 4-5 summarizes the sources of data used to estimate concentrations and Table 4-6 summarizes the actual exposure point concentrations used for the risk assessment (refer to Section 3.0 or 4.3 for details on the calculation of these values).

4.4.1 EXPOSURE POINT CONCENTRATIONS IN SOIL

These data represent a small number of soil samples collected from drainage ditches near the Site. Similar chemical concentrations were detected in all samples, probably due to natural and anthropogenic background conditions, and the fact that the drainages are connected. Because only a small number of samples were collected (*e.g.*, one sample downgradient of the Recticon facility), the UCL concentration would be similar to the maximum detected concentration. The maximum detected concentrations from all surface samples were used in the calculation of exposure for the trespasser, onsite worker, and onsite resident scenarios.

Direct contact was not considered plausible for two media that were sampled, subsurface soil and surface water (see Section 4.3). Therefore, no exposure concentrations were selected from these media. However, because subsurface soil may serve as a source of chemical vapors for the air pathways, some subsurface soil samples were used in the modeling for the air pathway if soil gas samples were unavailable.

4.4.2 EXPOSURE POINT CONCENTRATIONS IN AIR

Concentrations in indoor and outdoor air were estimated using the emissions models described in the Section 4.3.

4.4.3 EXPOSURE POINT CONCENTRATIONS IN GROUNDWATER

Current

Chemical exposure to offsite receptors is likely to be mitigated by the measures (the installation of filtration systems and routing monitoring) taken as part of the Removal Action. Since the target concentration for these wells are MCLs, the analytical detection limits are higher in these monitoring samples than samples collected at the Site. These samples used were collected from actual drinking water wells (not monitoring wells) which are near the site but treated by carbon filtration. Although most of the samples resulted in non-detections, the maximum detected concentrations were used to calculate risks for the current scenario. No onsite exposure was considered, because the Site is currently vacant.

Future

The potential risks to onsite residents and workers under the future scenario were calculated using 95% UCL concentrations for the shallow bedrock aquifer. The 95% UCL concentrations are similar to the concentrations detected in the center of the plume. All the chemicals detected in groundwater at the Site will be considered.

4.5 QUANTIFICATION OF INTAKES

This section describes the methods used for calculating potential chemical intakes for the populations and exposure pathways selected for quantitative evaluation. The intakes calculated in this

section are expressed as the amount of chemical at the exchange boundary (*i.e.*, skin,[3] lungs or gut) and available for absorption. Estimates of chemical intakes based on RME scenarios are presented in this section. Calculations and input parameters used for estimating intake rates through the inhalation, soil ingestion, groundwater ingestion, and dermal contact with soil and groundwater pathways were obtained from EPA (EPA, 1989a; 1990c; 1991a), and are presented below. The input parameters and assumptions used to estimate reasonable maximum exposures are presented in Tables 4-6 and 4-7.

The calculations used to estimate exposure or intake from contact with chemicals in soil have the same general components: 1) a variable representing chemical concentration, 2) variables describing the characteristics of the exposed population, and 3) an assessment-determined variable that defines the time frame over which exposure occurs. The general mathematical relationship between these variables and chemical intake in humans is:

$$I = \frac{(C)\ (CR)\ (EF)\ (ED)}{(AT)\ (BW)} \qquad (12)$$

where,

I	=	Intake (mg/kg/day)
C	=	Representative concentration in the contaminated medium contacted over the exposure period (either mg/kg, mg/L or mg/m^3)
CR	=	Contact rate; the quantity of contaminated medium contacted per unit time (mg/day, L/day, or m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time; period over which exposure is averaged (days)
BW	=	Body weight (kg)

Intake is calculated as either the Average Daily Dose (ADD) or the Lifetime Average Daily Dose (LADD). The ADD is used in the evaluation of non-carcinogenic health effects, while the LADD is used to evaluate carcinogenic effects (the evaluation of these intakes is discussed further in Section 6.0). These

[3]Please note that in keeping with EPA guidance, intake for dermal exposure pathways are estimated in terms of absorbed dose and not quantity of chemical at the exchange boundary.

two intake rates differ in the averaging time (AT) variable. When evaluating non-carcinogenic effects, intakes (ADD) are calculated by averaging intake over the period of exposure (exposure duration, or ED). For carcinogens, intakes (LADDs) are calculated by prorating the average daily dose over a lifetime. Non-carcinogenic effects are expected to appear only after a threshold (the point at which the organism's protective mechanisms are overwhelmed; no adverse effects are expected below that level) is exceeded during the period of exposure. Carcinogenic compounds are assumed to posses a linear dose-response relationship; every unit of chemical will produce a small but finite increase in cancer risk over the lifetime of the organism. The other exposure parameters are discussed and evaluated in the following sections. The results of these calculations are presented and discussed in Section 6.0.

4.5.1 SOIL: DERMAL CONTACT

EPA guidelines on assessing dermal absorption of chemicals from soil are still evolving. In this risk assessment, the dose from dermal contact with soil can be estimated from the following equation:

$$Absorbed\ Dose = \frac{(C_S)\ (F)\ (SA)\ (AF)\ (ABS)\ (EF)\ (ED)\ (10^{-6})}{(BW)\ (AT)\ (365)} \qquad (13)$$

where,

Dose	=	ADD or LADD (mg/kg/day)
C_s	=	Soil concentration of chemical (mg/kg)
F	=	Fraction from chemical-containing soil (unitless)
SA	=	Surface area of exposed skin of an adult (cm^2)
AF	=	Soil adherence factor ($mg/cm^2/day$)
ABS	=	Absorption factor (unitless)
EF	=	Exposure frequency (days/years)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
10^{-6}	=	Conversion factor (kg/mg)
365	=	Conversion factor (days/year)

4.5.2 SOIL: INGESTION

The equation to calculate intake from the ingestion of soil can be expressed as:

$$Intake = \frac{(C_S)\ (F)\ (Is)\ (EF)\ (ED)\ (10^{-6})}{(BW)\ (AT)\ (365)} \quad (14)$$

where,

Intake	=	ADD or LADD (mg/kg/day)
C_S	=	Soil concentration of chemical (mg/kg)
F	=	Fraction from chemical-containing soil (unitless)
Is	=	Soil ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
10^{-6}	=	Conversion factor (kg/mg)
365	=	Conversion factor (days/year)

4.5.3 AIR: PARTICULATE INHALATION

The equation to calculate intake from particulate inhalation can be expressed as:

$$Intake = \frac{(C_S)\ (F)\ (PM_{10})\ (Br)\ (Pd)\ (ET)\ (EF)\ (ED)\ (10^{-6})}{(BW)\ (AT)\ (365)} \quad (15)$$

where,

Intake	=	ADD or LADD (mg/kg/day)
C_S	=	Concentration of chemical in soil (mg/kg)
F	=	Fraction from chemical-containing soil (unitless)
PM_{10}	=	Particulate matter less than 10 microns (mg/m^3)
Br	=	Breathing rate (m^3/hour)
Pd	=	Particulate deposition to lung (unitless)

ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
10^{-6}	=	Conversion factor (kg/mg)
365	=	Conversion factor (days/year)

4.5.4 AIR: VAPOR INHALATION

The following equation was used to calculate the intake associated with the inhalation of chemicals in air:

$$Intake = \frac{(C_A)\ (Br)\ (ET)\ (EF)\ (ED)}{(BW)\ (AT)\ (365)} \qquad (16)$$

where,

Intake	=	ADD or LADD (mg/kg/day)
C_A	=	Air concentration of contaminant (mg/m^3)
Br	=	Breathing rate (m^3/hour)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
365	=	Conversion factor (days/year)

The concentrations of contaminants in air were estimated using the models described in Section 4.3.

4.5.5 GROUNDWATER: INGESTION OF DRINKING WATER

The following equation was used to calculate the intake associated with the ingestion of chemicals in groundwater:

$$Intake = \frac{(C_W)\ (I_W)\ (EF)\ (ED)}{(BW)\ (AT)\ (365)} \qquad (17)$$

where,

Intake	=	ADD or LADD (mg/kg/day)
C_W	=	Chemical concentration in water (mg/L)
I_W	=	Ingestion rate (L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
365	=	Conversion factor (days/year)

4.5.6 GROUNDWATER: DERMAL CONTACT (DURING SHOWERING OR BATHING)

The dose from dermal contact can be estimated from the following equation:

$$Absorbed\ Dose = \frac{(C_w)\ (SA)\ (PC)\ (ET)\ (EF)\ (ED)\ (10^{-3})}{(BW)\ (AT)\ (365)}$$

where,

Absorbed Dose	=	ADD or LADD (mg/kg/day)
C_w	=	Chemical concentration in water (mg/L)
SA	=	Surface area of exposed skin (cm^2)
PC	=	Chemical-specific dermal permeability constant (cm/hr)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)

ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (years)
10^{-3}	=	Conversion factor (L/cm^3)
365	=	Conversion factor (days/year)

The permeability constants were obtained from EPA (1991a), and are presented in Table 4-8.

4.5.7 GROUNDWATER: INHALATION OF VAPORS (DURING SHOWERING)

The intake from the inhalation of vapors was estimated by assuming that the intakes are equivalent to the intake from the groundwater ingestion pathway.

4.6 UNCERTAINTIES RELATED TO THE EXPOSURE ASSESSMENT

Uncertainties in the exposure assessment include:

- The extent to which monitoring data are representative of potential exposures from the Site;
- Uncertainties in the models, assumptions and input variables used to estimate exposure concentrations; and
- The extent that values used for intake variables (*i.e.*, drinking water ingestion rate, inhalation rate) are representative of potential exposures from the Site. Also, the use of multiple assumptions could magnify the uncertainties in estimated exposures.

TABLE 4-1
MATRIX OF POTENTIAL EXPOSURE ROUTES
FOR THE RECTICON/ALLIED STEEL SITE

EXPOSURE MEDIUM/ EXPOSURE ROUTE	CURRENT ONSITE TRESPASSER	CURRENT/FUTURE OFFSITE RESIDENTIAL POPULATION	FUTURE ONSITE COMMERCIAL/ INDUSTRIAL POPULATION	FUTURE POTENTIAL ONSITE RESIDENTIAL POPULATION
Groundwater				
Ingestion	--	L	A	L
Dermal Contact	--	L	A	L
Vapor Inhalation	--	L	A	L
Surface Water				
Ingestion	I	--	--	I
Dermal Contact	I	--	--	I
Sediment				
Incidental Ingestion	--	--	--	--
Dermal Contact	--	--	--	--
Air				
Inhalation of Vapors				
Indoors	--	L	A	L
Outdoors	I	L	A	L
Inhalation of Particulates	I	--	A	L
Soil/Dust				
Incidental Ingestion	I	--	A	L, I
Dermal Contact	I	--	A	L, I
Food				
Ingestion	--	--	--	--

L = Lifetime exposure.
A = Exposure to adults (highest exposure is likely to occur during occupational activities).
-- = Exposure of this population via this route is not likely to occur.
I = Intermittent exposure.

TABLE 4-2
SOURCE OF INITIAL CONCENTRATIONS USED TO CALCULATE CONCENTRATIONS IN INDOOR AND OUTDOOR AIR FOR THE RECTICON/ALLIED STEEL SITE

AIR PATHWAY	SCENARIO	SAMPLE CONCENTRATIONS USED IN MODELLING				
		SOIL GAS		SUBSURFACE SOIL		GROUNDWATER
ALLIED FACILITY						
Outdoor	Current - trespasser	95% UCL of all Allied Steel samples	or	Maximum concentrations of all Allied Steel samples	and	95% UCL of overburden aquifer samples
	Future - onsite worker					
	Future - onsite resident					
Indoor	Future - onsite resident					
	Future - onsite worker	Maximum concentrations near building	or	Maximum concentration near building	and	Maximum concentrations near building
RECTICON FACILITY						
Outdoor	Current - trespasser	95% UCL of samples from unpaved areas	or	Maximum concentrations of all Recticon samples	and	95% UCL of overburden samples
	Future - onsite worker					
	Future - onsite resident	95% UCL of samples from paved areas				
Indoor	Future - onsite resident					
	Future - onsite worker	Maximum concentrations near building	or	Maximum concentrations near building	and	Maximum concentrations near building
OFF SITE						
Outdoor	Current - offsite resident	Not applicable				95% UCL of overburden aquifer samples
Indoor	Current - offsite resident					

TABLE 4-3
SUMMARY OF MAXIMUM CHEMICAL CONCENTRATIONS NEAR BUILDINGS
AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	MEDIA	SAMPLE LOCATION	SAMPLE CONCENTRATION
ALLIED STEEL FACILITY			
SVOCs			
Benzoic acid	Subsurface Soil Sample	C5	0.12 mg/kg
bis(2-Ethylhexyl)phthalate	Overburden Aquifer Sample	OB-7	0.001 mg/L
VOCs			
cis-1,2-Dichloroethene	Overburden Aquifer Sample	OB-7	0.00029 mg/L
1,1,1-Trichloroethane	Overburden Aquifer Sample	OB-7	0.00038 mg/L
Benzene	Soil Gas Sample	G5	2 µg/L
Carbon tetrachloride	Soil Gas Sample	G1	0.002 µg/L
Chloroform	Soil Gas Sample	G5	0.029 µg/L
Ethylbenzene	Soil Gas Sample	G5	0.7 µg/L
Methylene chloride	Overburden Aquifer Sample	OB-7	0.00036 mg/L
Tetrachloroethene	Soil Gas Sample	G1	3 µg/L
Toluene	Soil Gas Sample	G5	10 µg/L
Trichloroethane (total)	Soil Gas Sample	D11	0.2 µg/L
Trichloroethene	Soil Gas Sample	D11	0.3 µg/L
Xylenes (mixed)	Soil Gas Sample	G7	8 µg/L
RECTICON FACILITY			
VOCs			
Acetone	Subsurface Soil Sample	G2	0.114 mg/kg
Carbon tetrachloride	Soil Gas Sample	C5	0.001 µg/L
Chloroform	Soil Gas Sample	G2	0.05 µg/L
Methylene chloride	Subsurface Soil Sample	G2	0.003 mg/kg
Tetrachloroethene	Soil Gas Sample	G2	0.007 µg/L
Toluene	Soil Gas Sample	C3	2 µg/L
Trichloroethane (total)	Soil Gas Sample	G2	0.2 µg/L
Trichloroethene	Soil Gas Sample	G2, C5	6 µg/L

SUMMARY OF SAMPLE LOCATIONS WITHIN TEN FEET OF ANY BUILDING
AT THE RECTICON/ALLIED STEEL FACILITY

GROUNDWATER LOCATION	SOIL GAS LOCATIONS	SOIL BORING LOCATIONS
Allied Steel Facility		
2OB-7	C1, 3, 5, 7, 9 D11 E1, 11 F11 G1, 3, 5, 7, 9	C5
Recticon Facility		
None	C1, 3,5,7 D9 F9 G1, 2 H7, 9	G2

Table 4-4
Physical and Chemical Properties Used in the Environmental Fate and Transport Modeling for the Vapor Inhalation Pathway
(Chemicals in Groundwater and Subsurface Soils Only)

Chemical	Molecular Weight (g/mol)	Water Solubility* (mg/L)	Vapor Pressure* (mmHg)	Henry's Law Constant* (atm m^3/mol)	Koc* (ml/g)	foc	Kd** (ml/g)	log kow*	Diffusion Coefficient*** (cm^2/s)
SVOCs									
Benzoic Acid	122 (a)	3333 (a)	0.00523 (b)	7.00E-08 (a)	19.2 (c)	0.0158	0.30	-1.23 (d)	0.06956 (e)
bis(2-ethylhexyl)phthalate (f)	391	0.3	6.45E-06	1.10E-05	14350 (g)	0.0158	226.7	5.11	0.05483 (e)
Di-n-butylphthalate	278	13	1.00E-05	2.82E-07	170000	0.0158	2686	5.60	0.04252 (e)
TICs									
1,1,2-Trichloro-1,2,2-trifluoroethane (f)	187	170	362	5.26E-01	426 (h)	0.0158	6.73	3.16	0.05784 (e)
tert-butylmethylether (a)	88	51000	249	5.87E-04	11.2	0.0158	0.18	0.59 (i)	0.07382 (e)
VOCs									
1,1,1-Trichloroethane	133	1500	123	1.44E-02	152	0.0158	2.40	2.50	0.07496
1,1,2-Trichloroethane	133	4500	30	1.17E-03	56	0.0158	0.88	2.47	0.07496
Trichloroethane (total) (j)	133	4500	30	1.17E-03	56	0.0158	0.88	2.47	0.07496
1,1-Dichloroethane	99	5500	182	4.31E-03	30	0.0158	0.47	1.79	0.08557
1,1-Dichloroethene	97	2250	600	3.40E-02	65	0.0158	1.03	1.84	0.07442
1,2-Dichloroethane	99	8520	64	9.78E-04	14	0.0158	0.22	1.48	0.08557
1,2-Dichloroethene (k)	97	5628	296	6.81E-03	56.6	0.0158	0.89	0.36	0.07442
cis-1,2-Dichloroethene	97	3500	208	7.58E-03	49	0.0158	0.77	0.70	0.07442
trans-1,2-Dichloroethene	97	6300	324	6.56E-03	59	0.0158	0.93	0.48	0.07442
Acetone	58	1000000	270	2.06E-05	2.2	0.0158	0.035	-0.24	0.09699
Benzene	78	1750	95	5.59E-03	83	0.0158	1.31	2.12	0.08195
Carbon Tetrachloride	154	757	90	2.41E-02	110	0.0158	1.74	2.64	0.07500
Chloroethane (f)	65	5710	766	8.48E-03	33.1 (l)	0.0158	0.52	1.43	0.09789
Chioroform	120	8200	151	2.87E-03	31	0.0158	0.49	1.97	0.08345
Ethylbenzene	106	152	7	6.43E-03	1100	0.0158	17.4	3.15	0.06274
Methylene Chloride	85	20000	362	2.03E-03	8.8	0.0158	0.14	1.30	0.09610
Tetrachloroethene	166	150	17.8	2.59E-02	364	0.0158	5.75	2.60	0.06968
Toluene	92	535	28.1	6.37E-03	300	0.0158	4.74	2.73	0.07367
Trichloroethene	131	1100	58	9.10E-03	126	0.0158	1.99	2.38	0.07638
Trichlorofluoromethane	137	1100	667	1.34E-01 (m)	159	0.0158	2.51	2.53	0.07391
Xylenes (mixed)	106	198	10	7.09E-03	240	0.0158	3.79	3.26	0.06742

Table 4-4
Physical and Chemical Properties Used in the Environmental Fate and Transport Modeling for the Vapor Inhalation Pathway
(Chemicals in Groundwater and Subsurface Soils Only)

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* Data obtained from SPHEM (EPA, 1986f) unless otherwise noted.
** Values calculated as Kd = (Koc) x (foc)
*** Values obtained from Table 2-3 (assuming an ambient temperature of 10 degrees C unless otherwise noted, SEAM (EPA, 1988b).

(a) Value obtained from HSDB (EPA, 1992c).
(b) Value calculated using the CHEMEST computer program (method 2).
(c) Calculated using regression equation 4-6 (Lyman et al., 1990), as shown below:
log Koc = -0.54 log S + 0.44, where water solubility (S) is in units of (mol/L).
(d) Calculated using: log Kow = (log 1/S + 0.339) / (0.996), where water solubility (S) is in units of (mol/L).
(as adapted from regression equation 2-12 (Lyman et al., 1990), for estimating S from Kow).
(e) Calculated value using Fuller's method as described in EPA, 1988b.
(f) Values obtained from Howard, 1990.
(g) Calculated using regression equation 4-8 (Lyman et al., 1990), as shown below:
log Koc = 0.544 log Kow + 1.377
(h) Calculated using regression equation 4-7 (Lyman et al., 1990), as shown below:
log Koc = -0.557 log S + 4.277, where water solubility (S) is in units of (u mol/L).
(i) Calculated using: log Kow = (log 1/S + 0.935) / (1.182), where water solubility (S) is in units of (mol/L).
(as adapted from regression equation 2-8 (Lyman et al., 1990), for estimating S from Kow).
(j) Parameters listed are for 1,1,2-Trichloroethane.
(k) Calculated value based on isomer frequency/stability (% of cis- and trans- isomers in diene mixture).
where; Property (P) = [(P trans- isomer)(76%)] + [(P cis- isomer)(24%)]
(l) Value obtained from the toxicological profile for Chloroethane (ATSDR, 1989).
(m) Value calculated as the ratio of vapor pressure to solubility using the CHEMEST computer program.

TABLE 4-5
SELECTION OF EXPOSURE CONCENTRATIONS FOR THE RECTICON/ALLIED STEEL SITE

MEDIA	PATHWAY	CURRENT		FUTURE	
		TRESPASSER	OFFSITE RESIDENT	ONSITE WORKER	ONSITE RESIDENT
Soil	Dermal contact and soil ingestion	Maximum from all surface soil samples	None	Maximum from all surface soil samples	Maximum from all surface soil samples
	Particulate inhalation	Proportional to product of maximum soil concentration and PM_{10}	None	Proportional to product of maximum soil concentration and PM_{10}	Proportional to product of maximum soil concentration and PM_{10}
Air	Vapor inhalation	Modeling of emissions from soil gas (95% UCL), or soil (maximum) and groundwater (95% UCL) (see text)	Hypothetical exposure; modeling of emissions from groundwater (95% UCL)	Modeling of indoor (maximum concentrations) or outdoor (soil gas, 95% UCL; or soil, maximum, & groundwater 95% UCL) emissions.	Modeling of emissions from soil gas (95% UCL) or soil (maximum) and groundwater (95% UCL).
Groundwater	All	None	Detected concentrations (see text)	95% UCL in plume area	95% UCL in plume area

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
Soil			
Ingestion/Dermal Contact Pathways (in mg/kg)			
Applicable Scenarios: Current Trespasser, Future Onsite Worker, Future Onsite Resident			
Area: Recticon and Allied Steel facilities			
	METALS		
	Chromium	80.7	Maximum from all surface soil samples
	Copper	211	Maximum from all surface soil samples
	Lead	151	Maximum from all surface soil samples
	Nickel	28.7	Maximum from all surface soil samples
	Zinc	772	Maximum from all surface soil samples
	PAHs		
	2-Methylnaphthalene	0.7	Maximum from all surface soil samples
	Acenaphthylene	0.33	Maximum from all surface soil samples
	Anthracene	0.32	Maximum from all surface soil samples
	Benzo(a)anthracene	1	Maximum from all surface soil samples
	Benzo(a)pyrene	1.2	Maximum from all surface soil samples
	Benzo(b)fluoranthene	2	Maximum from all surface soil samples
	Benzo(g,h,i)perylene	0.81	Maximum from all surface soil samples
	Benzo(k)fluoranthene	0.95	Maximum from all surface soil samples
	Chrysene	1	Maximum from all surface soil samples
	Dibenz(a,h)anthracene	0.23	Maximum from all surface soil samples
	Dibenzofuran	0.3	Maximum from all surface soil samples
	Fluoranthene	1.6	Maximum from all surface soil samples
	Fluorene	0.12	Maximum from all surface soil samples
	Indeno(1,2,3-cd)pyrene	1.1	Maximum from all surface soil samples
	Naphthalene	0.4	Maximum from all surface soil samples
	Phenanthrene	1.6	Maximum from all surface soil samples
	Pyrene	1.6	Maximum from all surface soil samples
	SVOCs		
	Benzoic Acid	0.26	Maximum from all surface soil samples
	bis(2-ethylhexyl)phthalate	0.93	Maximum from all surface soil samples
	Butylbenzylphthalate	0.39	Maximum from all surface soil samples
	Di-n-butylphthalate	0.099	Maximum from all surface soil samples
	VOCs		
	Acetone	0.14	Maximum from all surface soil samples
	Trichloroethene	0.005	Maximum from all surface soil samples
Particulate Inhalation Pathway (estimated, in mg/m^3)			
Applicable Scenarios: Current Trespasser, Future Onsite Worker, Future Onsite Resident			
Area: Recticon and Allied Steel facilities			
	METALS		
	Chromium	2.18E-06	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Copper	5.70E-06	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Lead	4.08E-06	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Nickel	7.75E-07	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Zinc	2.08E-05	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
	PAHs		
	2-Methylnaphthalene	1.89E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Acenaphthylene	8.91E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Anthracene	8.64E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Benzo(a)anthracene	2.70E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Benzo(a)pyrene	3.24E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Benzo(b)fluoranthene	5.40E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Benzo(g,h,i)perylene	2.19E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Benzo(k)fluoranthene	2.57E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Chrysene	2.70E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Dibenz(a,h)anthracene	6.21E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Dibenzofuran	8.10E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Fluoranthene	4.32E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Fluorene	3.24E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Indeno(1,2,3-cd)pyrene	2.97E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Naphthalene	1.08E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Phenanthrene	4.32E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Pyrene	4.32E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	SVOCs		
	Benzoic Acid	7.02E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	bis(2-ethylhexyl)phthalate	2.51E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Butylbenzylphthalate	1.05E-08	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Di-n-butylphthalate	2.67E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	VOCs		
	Acetone	3.78E-09	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
	Trichloroethene	1.35E-10	Proportional to Soil Concentration multiplied by PM10 (0.027 mg/m^3)
Air			
Vapor Inhalation Pathway (indoors, in mg/m^3)			
	Applicable Scenario: Future Onsite Worker		
	Area: Allied Steel facility		
	SVOCs		
	Benzoic Acid	1.3E-10	Based on indoor air model using maximum concentrations near building
	bis(2-ethylhexyl)phthalate	4.5E-12	Based on indoor air model using maximum concentrations near building
	VOCs		
	1,1,1-Trichloroethane	3E-09	Based on indoor air model using maximum concentrations near building
	cis-1,2-Dichloroethene	1.2E-09	Based on indoor air model using maximum concentrations near building
	Trichloroethane (total)	7.8E-08	Based on indoor air model using maximum concentrations near building
	Benzene	8.5E-07	Based on indoor air model using maximum concentrations near building
	Carbon Tetrachloride	7.8E-10	Based on indoor air model using maximum concentrations near building
	Chloroform	1.3E-08	Based on indoor air model using maximum concentrations near building
	Ethylbenzene	2.3E-07	Based on indoor air model using maximum concentrations near building
	Methylene Chloride	5.2E-10	Based on indoor air model using maximum concentrations near building
	Tetrachloroethene	1.1E-06	Based on indoor air model using maximum concentrations near building
	Toluene	3.8E-06	Based on indoor air model using maximum concentrations near building
	Trichloroethene	1.2E-07	Based on indoor air model using maximum concentrations near building
	Xylenes (mixed)	2.8E-06	Based on indoor air model using maximum concentrations near building

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
Area: Recticon facility			
	VOCs		
	Trichloroethane (total)	9.1E-08	Based on indoor air model using maximum concentrations near building
	Acetone	4E-07	Based on indoor air model using maximum concentrations near building
	Carbon Tetrachloride	4.6E-10	Based on indoor air model using maximum concentrations near building
	Chloroform	2.5E-08	Based on indoor air model using maximum concentrations near building
	Methylene Chloride	2.5E-07	Based on indoor air model using maximum concentrations near building
	Tetrachloroethene	3E-09	Based on indoor air model using maximum concentrations near building
	Toluene	9E-07	Based on indoor air model using maximum concentrations near building
	Trichloroethene	2.8E-06	Based on indoor air model using maximum concentrations near building
Applicable Scenario: Future Onsite Resident			
Area: Allied Steel facility			
	SVOCs		
	Benzoic Acid	1.3E-10	Based on indoor air model (see Section 4.3)
	bis(2-Ethylhexyl)phthalate	5.6E-11	Based on indoor air model (see Section 4.3)
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane	4.5E-07	Based on indoor air model (see Section 4.3)
	tert-butylmethylether	3.8E-10	Based on indoor air model (see Section 4.3)
	VOCs		
	1,1,1-Trichloroethane	1.3E-08	Based on indoor air model (see Section 4.3)
	Trichloroethane (total)	7E-09	Based on indoor air model (see Section 4.3)
	1,1-Dichloroethane	7.7E-09	Based on indoor air model (see Section 4.3)
	1,1-Dichloroethene	6.2E-09	Based on indoor air model (see Section 4.3)
	1,2-Dichloroethane	1.6E-09	Based on indoor air model (see Section 4.3)
	cis-1,2-Dichloroethene	2E-07	Based on indoor air model (see Section 4.3)
	trans-1,2-Dichloroethene	9E-10	Based on indoor air model (see Section 4.3)
	Benzene	9E-08	Based on indoor air model (see Section 4.3)
	Carbon tetrachloride	2E-10	Based on indoor air model (see Section 4.3)
	Chloroethane	1.6E-09	Based on indoor air model (see Section 4.3)
	Chloroform	1.3E-09	Based on indoor air model (see Section 4.3)
	Ethylbenzene	1.3E-07	Based on indoor air model (see Section 4.3)
	Methylene Chloride	9.2E-08	Based on indoor air model (see Section 4.3)
	Tetrachloroethene	5.8E-08	Based on indoor air model (see Section 4.3)
	Toluene	4.1E-07	Based on indoor air model (see Section 4.3)
	Trichloroethene	3.5E-08	Based on indoor air model (see Section 4.3)
	Trichlorofluoromethane	1.8E-08	Based on indoor air model (see Section 4.3)
	Xylenes (mixed)	7.6E-07	Based on indoor air model (see Section 4.3)
Area: Recticon facility			
	SVOCs		
	Benzoic Acid	9.6E-11	Based on indoor air model using samples from paved areas
	bis(2-ethylhexyl)phthalate	4.5E-11	Based on indoor air model using samples from paved areas
	Di-n-butylphthalate	4.3E-14	Based on indoor air model using samples from paved areas
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane	4.5E-07	Based on indoor air model using samples from paved areas
	tert-butylmethylether	3.8E-10	Based on indoor air model using samples from paved areas

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
	VOCs		
	1,1,1-Trichloroethane	1.3E-08	Based on indoor air model using samples from paved areas
	Trichloroethane (total)	1.5E-07	Based on indoor air model using samples from paved areas
	1,1-Dichloroethane	7.7E-09	Based on indoor air model using samples from paved areas
	1,1-Dichloroethene	6.2E-09	Based on indoor air model using samples from paved areas
	1,2-Dichloroethane	1.6E-09	Based on indoor air model using samples from paved areas
	cis-1,2-Dichloroethene	2E-07	Based on indoor air model using samples from paved areas
	trans-1,2-Dichloroethene	9E-10	Based on indoor air model using samples from paved areas
	1,2-Dichloroethene (total)	1.6E-06	Based on indoor air model using samples from paved areas
	Acetone	4E-07	Based on indoor air model using samples from paved areas
	Benzene	9.8E-10	Based on indoor air model using samples from paved areas
	Carbon Tetrachloride	9.4E-08	Based on indoor air model using samples from paved areas
	Chloroethane	1.6E-09	Based on indoor air model using samples from paved areas
	Chloroform	3.9E-09	Based on indoor air model using samples from paved areas
	Methylene Chloride	2.5E-07	Based on indoor air model using samples from paved areas
	Tetrachloroethene	3.9E-09	Based on indoor air model using samples from paved areas
	Toluene	8.4E-07	Based on indoor air model using samples from paved areas
	Trichloroethene	2.1E-07	Based on indoor air model using samples from paved areas
	Trichlorofluoromethane	1.8E-08	Based on indoor air model using samples from paved areas
	Xylenes (mixed)	8.8E-10	Based on indoor air model using samples from paved areas
	Applicable Scenario: Current Offsite Resident		
	Area: Offsite		
	SVOCs		
	bis(2-Ethylhexyl)phthalate	4.5E-11	Based on indoor air model using 95% UCL of Overburden aquifer samples
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane (h	4.5E-07	Based on indoor air model using 95% UCL of Overburden aquifer samples
	tert-butylmethylether	3.8E-10	Based on indoor air model using 95% UCL of Overburden aquifer samples
	VOCs		
	1,1,1-Trichloroethane	1.3E-08	Based on indoor air model using 95% UCL of Overburden aquifer samples
	1,1-Dichloroethane	7.7E-09	Based on indoor air model using 95% UCL of Overburden aquifer samples
	1,1-Dichloroethene	6.2E-09	Based on indoor air model using 95% UCL of Overburden aquifer samples
	1,2-Dichloroethane	1.6E-09	Based on indoor air model using 95% UCL of Overburden aquifer samples
	cis-1,2-Dichloroethene	2E-07	Based on indoor air model using 95% UCL of Overburden aquifer samples
	trans-1,2-Dichloroethene	9E-10	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Benzene	9.8E-10	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Chloroethane	1.6E-09	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Methylene Chloride	5.9E-10	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Tetrachloroethene	8.4E-08	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Trichloroethene	1.3E-06	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Trichlorofluoromethane	1.8E-08	Based on indoor air model using 95% UCL of Overburden aquifer samples
	Xylenes (mixed)	8.8E-10	Based on indoor air model using 95% UCL of Overburden aquifer samples
Vapor Inhalation Pathway (outdoors, in mg/m^3)			
	Applicable Scenarios: Current Trespasser, Future Onsite Worker, Future Onsite Resident		
	Area: Allied Steel facility		
	SVOCs		
	Benzoic Acid	4.1E-10	Based on outdoor air model (see Section 4.3)
	bis(2-Ethylhexyl)phthalate	1.8E-10	Based on outdoor air model (see Section 4.3)

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane	1.5E-06	Based on outdoor air model (see Section 4.3)
	tert-butylmethylether	1.3E-09	Based on outdoor air model (see Section 4.3)
	VOCs		
	1,1,1-Trichloroethane	4.1E-08	Based on outdoor air model (see Section 4.3)
	Trichloroethane (total)	2.3E-08	Based on outdoor air model (see Section 4.3)
	1,1-Dichloroethane	2.5E-08	Based on outdoor air model (see Section 4.3)
	1,1-Dichloroethene	2E-08	Based on outdoor air model (see Section 4.3)
	1,2-Dichloroethane	5.2E-09	Based on outdoor air model (see Section 4.3)
	cis-1,2-Dichloroethene	6.6E-07	Based on outdoor air model (see Section 4.3)
	trans-1,2-Dichloroethene	3E-09	Based on outdoor air model (see Section 4.3)
	Benzene	3E-07	Based on outdoor air model (see Section 4.3)
	Carbon Tetrachloride	6.4E-10	Based on outdoor air model (see Section 4.3)
	Chloroethane	5.3E-09	Based on outdoor air model (see Section 4.3)
	Chloroform	4.1E-09	Based on outdoor air model (see Section 4.3)
	Ethylbenzene	4.2E-07	Based on outdoor air model (see Section 4.3)
	Methylene Chloride	3E-07	Based on outdoor air model (see Section 4.3)
	Tetrachloroethene	1.9E-07	Based on outdoor air model (see Section 4.3)
	Toluene	1.3E-06	Based on outdoor air model (see Section 4.3)
	Trichloroethene	1.1E-07	Based on outdoor air model (see Section 4.3)
	Trichlorofluoromethane	6E-08	Based on outdoor air model (see Section 4.3)
	Xylenes (mixed)	2.5E-06	Based on outdoor air model (see Section 4.3)
	Applicable Scenarios: Current Trespasser, Future Onsite Worker		
	Area: Recticon facility		
	SVOCs		
	Benzoic Acid	3.2E-10	Based on outdoor air model using samples from unpaved areas
	bis(2-ethylhexyl)phthalate	1.5E-10	Based on outdoor air model using samples from unpaved areas
	Di-n-butylphthalate	1.4E-13	Based on outdoor air model using samples from unpaved areas
	TICs		Based on outdoor air model using samples from unpaved areas
	1,1,2-Trichloro-1,2,2-trifluoroethane	1.5E-06	Based on outdoor air model using samples from unpaved areas
	tert-butylmethylether	1.3E-09	Based on outdoor air model using samples from unpaved areas
	VOCs		Based on outdoor air model using samples from unpaved areas
	1,1,1-Trichloroethane	4.1E-08	Based on outdoor air model using samples from unpaved areas
	Trichloroethane (total)	1.3E-08	Based on outdoor air model using samples from unpaved areas
	1,1-Dichloroethane	2.5E-08	Based on outdoor air model using samples from unpaved areas
	1,1-Dichloroethene	2E-08	Based on outdoor air model using samples from unpaved areas
	1,2-Dichloroethane	5.2E-09	Based on outdoor air model using samples from unpaved areas
	cis-1,2-Dichloroethene	6.6E-07	Based on outdoor air model using samples from unpaved areas
	trans-1,2-Dichloroethene	3E-09	Based on outdoor air model using samples from unpaved areas
	1,2-Dichloroethene (total)	5.4E-06	Based on outdoor air model using samples from unpaved areas
	Acetone	1.3E-06	Based on outdoor air model using samples from unpaved areas
	Benzene	3.2E-09	Based on outdoor air model using samples from unpaved areas
	Carbon Tetrachloride	6E-10	Based on outdoor air model using samples from unpaved areas
	Chloroethane	5.3E-09	Based on outdoor air model using samples from unpaved areas
	Chloroform	2.5E-09	Based on outdoor air model using samples from unpaved areas
	Methylene Chloride	8.4E-07	Based on outdoor air model using samples from unpaved areas
	Tetrachloroethene	8.4E-10	Based on outdoor air model using samples from unpaved areas
	Toluene	7E-07	Based on outdoor air model using samples from unpaved areas
	Trichloroethene	9E-07	Based on outdoor air model using samples from unpaved areas
	Trichlorofluoromethane	6E-08	Based on outdoor air model using samples from unpaved areas
	Xylenes (mixed)	2.9E-09	Based on outdoor air model using samples from unpaved areas

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
Applicable Scenario: Current Offsite Resident			
Area: Offsite			
	SVOCs		
	bis(2-Ethylhexyl)phthalate	1.5E-10	Based on outdoor air model using samples from the Overburden aquifer
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane (h	1.5E-06	Based on outdoor air model using samples from the Overburden aquifer
	tert-butylmethylether	1.3E-09	Based on outdoor air model using samples from the Overburden aquifer
	VOCs		
	1,1,1-Trichloroethane	4.1E-08	Based on outdoor air model using samples from the Overburden aquifer
	1,1-Dichloroethane	2.5E-08	Based on outdoor air model using samples from the Overburden aquifer
	1,1-Dichloroethene	2E-08	Based on outdoor air model using samples from the Overburden aquifer
	1,2-Dichloroethane	5.2E-09	Based on outdoor air model using samples from the Overburden aquifer
	cis-1,2-Dichloroethene	6.6E-07	Based on outdoor air model using samples from the Overburden aquifer
	trans-1,2-Dichloroethene	3E-09	Based on outdoor air model using samples from the Overburden aquifer
	Benzene	3.2E-09	Based on outdoor air model using samples from the Overburden aquifer
	Chloroethane	5.3E-09	Based on outdoor air model using samples from the Overburden aquifer
	Methylene Chloride	1.9E-09	Based on outdoor air model using samples from the Overburden aquifer
	Tetrachloroethene	2.8E-07	Based on outdoor air model using samples from the Overburden aquifer
	Trichloroethene	4.3E-06	Based on outdoor air model using samples from the Overburden aquifer
	Trichlorofluoromethane	6E-08	Based on outdoor air model using samples from the Overburden aquifer
	Xylenes (mixed)	2.9E-09	Based on outdoor air model using samples from the Overburden aquifer
Applicable Scenario: Future Onsite Resident			
Area: Recticon facility			
	SVOCs		
	Benzoic Acid	3.2E-10	Based on outdoor air model using samples from paved areas
	bis(2-ethylhexyl)phthalate	1.5E-10	Based on outdoor air model using samples from paved areas
	Di-n-butylphthalate	1.4E-13	Based on outdoor air model using samples from paved areas
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane	1.5E-06	Based on outdoor air model using samples from paved areas
	tert-butylmethylether	1.3E-09	Based on outdoor air model using samples from paved areas
	VOCs		
	1,1,1-Trichloroethane	4.1E-08	Based on outdoor air model using samples from paved areas
	Trichloroethane (total)	4.9E-07	Based on outdoor air model using samples from paved areas
	1,1-Dichloroethane	2.5E-08	Based on outdoor air model using samples from paved areas
	1,1-Dichloroethene	2E-08	Based on outdoor air model using samples from paved areas
	1,2-Dichloroethane	5.2E-09	Based on outdoor air model using samples from paved areas
	cis-1,2-Dichloroethene	6.6E-07	Based on outdoor air model using samples from paved areas
	trans-1,2-Dichloroethene	3E-09	Based on outdoor air model using samples from paved areas
	1,2-Dichloroethene (total)	5.4E-06	Based on outdoor air model using samples from paved areas
	Acetone	1.3E-06	Based on outdoor air model using samples from paved areas
	Benzene	3.2E-09	Based on outdoor air model using samples from paved areas
	Carbon Tetrachloride	3.1E-07	Based on outdoor air model using samples from paved areas
	Chloroethane	5.3E-09	Based on outdoor air model using samples from paved areas
	Chloroform	1.3E-08	Based on outdoor air model using samples from paved areas
	Methylene Chloride	8.4E-07	Based on outdoor air model using samples from paved areas
	Tetrachloroethene	1.3E-08	Based on outdoor air model using samples from paved areas
	Toluene	2.7E-06	Based on outdoor air model using samples from paved areas
	Trichloroethene	6.9E-07	Based on outdoor air model using samples from paved areas
	Trichlorofluoromethane	6E-08	Based on outdoor air model using samples from paved areas
	Xylenes (mixed)	2.9E-09	Based on outdoor air model using samples from paved areas

Table 4-6
Summary of Exposure Concentrations Used in Calculations for the Recticon/Allied Steel Site

Media	Chemical	RME Exposure Concentration	Basis for Selection
Groundwater			
Ingestion/Dermal Contact/Inhalation Pathways (in mg/L)			
Applicable Scenarios: Future Onsite Worker, Future Onsite Resident			
Area: Recticon and Allied Steel facilities			
	METALS (total)		
	Aluminum	1.0121	95% UCL concentrations from shallow bedrock samples in plume area
	Arsenic	0.0017	95% UCL concentrations from shallow bedrock samples in plume area
	Barium	0.3041	95% UCL concentrations from shallow bedrock samples in plume area
	Beryllium	0.0008	95% UCL concentrations from shallow bedrock samples in plume area
	Chromium	0.0055	95% UCL concentrations from shallow bedrock samples in plume area
	Cobalt	0.0075	95% UCL concentrations from shallow bedrock samples in plume area
	Copper	0.0103	95% UCL concentrations from shallow bedrock samples in plume area
	Manganese	0.8203	95% UCL concentrations from shallow bedrock samples in plume area
	Nickel	0.0141	95% UCL concentrations from shallow bedrock samples in plume area
	Vanadium	0.0042	95% UCL concentrations from shallow bedrock samples in plume area
	SVOCs		
	Dimethylphthalate	0.0053	95% UCL concentrations from shallow bedrock samples in plume area
	TICs		
	1,1,2-Trichloro-1,2,2-trifluoroethane	0.0030	Maximum detected
	Carbon Disulfide	0.5600	Maximum detected
	tert-butylmethylether	0.0015	Maximum detected
	VOCs		
	1,1,1-Trichloroethane	0.0015	95% UCL concentrations from shallow bedrock samples in plume area
	1,1,2-Trichloroethane	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	1,1-Dichloroethane	0.0016	95% UCL concentrations from shallow bedrock samples in plume area
	1,1-Dichloroethene	0.0017	95% UCL concentrations from shallow bedrock samples in plume area
	1,2,3-Trichlorobenzene	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	1,2,4-Trimethylbenzene	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	1,2-Dichloroethane	0.0009	95% UCL concentrations from shallow bedrock samples in plume area
	cis-1,2-Dichloroethene	0.4138	95% UCL concentrations from shallow bedrock samples in plume area
	trans-1,2-Dichloroethene	0.0019	95% UCL concentrations from shallow bedrock samples in plume area
	1,3-Dichlorobenzene	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Benzene	0.0002	95% UCL concentrations from shallow bedrock samples in plume area
	Carbon Tetrachloride	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Chlorobenzene	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Chloroethane	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Chloroform	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Chloromethane	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Dichlorodifluoromethane	0.0004	95% UCL concentrations from shallow bedrock samples in plume area
	Methylene Chloride	0.0002	95% UCL concentrations from shallow bedrock samples in plume area
	Tetrachloroethene	0.0032	95% UCL concentrations from shallow bedrock samples in plume area
	Trichloroethene	1.0619	95% UCL concentrations from shallow bedrock samples in plume area
	Trichlorofluoromethane	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
	Vinyl Chloride	0.0008	95% UCL concentrations from shallow bedrock samples in plume area
	m,p-Xylene	0.0003	95% UCL concentrations from shallow bedrock samples in plume area
Applicable Scenario: Current Offsite Resident			
Area: Offsite			
	VOCs		
	1,1,1-Trichloroethane	4.00E-03	Maximum detected in offsite wells
	Methylene Chloride	2.00E-03	Maximum detected in offsite wells
	Toluene	6.00E-03	Maximum detected in offsite wells
	Trichloroethene	1.00E-03	Maximum detected in offsite wells

TABLE 4-7
SUMMARY OF EXPOSURE PARAMETERS USED TO ESTIMATE INTAKE FOR THE RECTICON/ALLIED STEEL SITE

PARAMETER	VALUE	SOURCE/RATIONALE
GENERAL PARAMETERS		
Lifetime Average Daily Dose (LADD) or Average Daily Dose (ADD)	mg/kg/day	Calculated
Soil Concentrations (C_s)	mg/kg	Representative concentrations based on samples from appropriate area
Groundwater Concentrations (C_w)	mg/L	Representative concentrations based on samples from appropriate area
Particulate Concentrations (C_p)	mg/m^3	Concentration based on the product of soil concentration and particulate measurements in area
Vapor Concentrations (C_v)	mg/m^3	Based on modeling results
Exposure Frequency (EF)		
Current		
Onsite trespasser	104 days/year	2 days per week
Offsite resident	350 days/year	EPA (1991a)
Future		
Onsite worker	250 days/year	5 days per week, 50 weeks per year
Onsite resident	350 days/year	EPA (1991a)
Exposure Duration (ED)		
Current		
Onsite trespasser	8 years	Years between ages 9-17 years
Offsite resident	30 years	EPA (1991a)
Future		
Onsite worker	25 years	Upper-bound estimate (EPA, 1991a)
Onsite resident	30 years	EPA (1991a)

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
Body Weight (BW)		
Current		
Onsite trespasser	50.6 kg	Median bodyweight of a child 9-17 years (EPA, 1989a)
Offsite resident		
Child	15.1 kg	EPA (1991a)
Adult	70 kg	EPA (1991a)
Normalized	59 kg	
Future		
Onsite worker	70 kg	EPA (1991a)
Onsite resident		
Child	15.1 kg	EPA (1991a)
Adult	70 kg	EPA (1991a)
Normalized	59 kg	
Averaging Time (AT)		
Non-carcinogens	Variable	Depends on period of exposure; see ED value
Carcinogens	70 years	Lifetime (EPA, 1990c)
Conversion Factors	365	Days per year
	10^{-6}	Kg per mg
	10^{-3}	L per cm^3

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
PATHWAY-SPECIFIC PARAMETERS		
DERMAL CONTACT WITH SOIL		
Fraction from Contaminated Source (F)		
Current		
Onsite trespasser	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Future		
Onsite worker	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Onsite resident	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Skin Surface Area (SA)		
Current		
Onsite trespasser	4,100 cm^2	Exposed hands, arms, and head of children between ages of 9-17 years (EPA, 1989b)
Future		
Onsite worker	4,300 cm^2	Mean value for exposed hands, arms, and head of adult males (EPA, 1990d)
Onsite resident		
Child	5,020 cm^2	Mean value for exposed hands, head, arms, and legs for a 6-7 year old male child (EPA, 1989b)
Adult	4,300 cm^2	Mean value for exposed hands, arms, and head of adult males (EPA, 1990d)
Normalized	4,444 cm^2	
Adherence Factor (AF)	1.0 $mg/cm^2/day$	Reasonable upper bound value (EPA, 1992d)
Absorption Factor (ABS)		
Metals	0.01	Professional judgement; per USEPA Region III comment
PAHs	0.13	Based on analogy to B[a]P, Wester *et al.*, 1990 (EPA, 1992d)
SVOCs	0.10	Professional judgement; per USEPA Region III comment
VOCs	0.25	Professional judgement; per USEPA Region III comment

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
SOIL INGESTION		
Fraction from Contamination Source (F)		
Current		
Onsite trespasser	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Future		
Onsite worker	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Onsite resident	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Soil Ingestion Rate (Is)		
Current		
Onsite trespasser	100 mg/day	EPA (1991a)
Future		
Onsite worker	50 mg/day	EPA (1991a)
Onsite resident		
Child	200 mg/day	EPA (1991a)
Adult	100 mg/day	EPA (1991a)
Normalized	120 mg/day	

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
PARTICULATE INHALATION		
Fraction from Contamination Source (F)		
Current		
Onsite trespasser	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Future		
Onsite worker	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Onsite resident	5%	Professional judgment, based on likelihood of encountering soils in drainage ditch. Drainage ditch is < 5% of total site area.
Particulate Matter < 10 microns (PM_{10})	0.027 mg/m^3	Annual PM_{10} average (1991) as measured from Norristown, Pennsylvania (personal communications with Jeff Miller of the Department of Environmental Resources, Bureau of Air Quality Control, Harrisburg, Pennsylvania).
Breathing Rate (Br)		
Residents (all)	0.83 m^3/hr	EPA (1990c)
Trespasser	0.83 m^3/hr	EPA (1990c)
Worker	2.5 m^3/hr	Based on worker inhalation rate of 20 m^3 per 8-hour work period.
Particulate Deposition to Lung (Pd)	1	Maximum
Exposure Time (Outdoors) (ET)		
Current		
Onsite trespasser	4 hours/day	Professional judgment
Future		
Onsite worker	1 hour/day	Professional judgment
Onsite resident	8 hours/day	Professional judgment

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
	VAPOR INHALATION	
Breathing Rate (Br)		
Residents (all)	0.83 m^3/hr	EPA (1990c)
Trespasser	0.83 m^3/hr	EPA (1990c)
Worker	2.5 m^3/hr	Based on worker inhalation rate of 20 m^3 per 8-hour work period
Exposure Time (ET)		
Current		
Onsite trespasser	4 hours/day	Professional judgment
Offsite resident		
Outdoors	8 hours/day	Professional judgment
Indoors	16 hours/day	Professional judgment
Future		
Onsite worker		
Outdoors	1 hour/day	Professional judgment
Indoors	7 hours/day	Professional judgment
Onsite resident		
Outdoors	8 hours/day	Professional judgment
Indoors	16 hours/day	Professional judgment
	GROUNDWATER INGESTION	
Ingestion Rate (I_w)		
Residents (all)	2.0 L/day	EPA (1990c)
Workers	2.0 L/day	EPA (1990c)

TABLE 4-7 (CONTINUED)

PARAMETER	VALUE	SOURCE/RATIONALE
DERMAL CONTACT (SHOWERING/BATHING)		
Skin Surface Area (SA)		
Future		
Onsite resident		
Child	7,280 cm^2	50th percentile of total surface area males 3-6 years old (EPA, 1989a)
Adult	19,400 cm^2	50th percentile of total surface area adult males (EPA, 1989a)
Normalized	17,000 cm^2	
Exposure Time (ET)		
Future onsite residents (all)	0.25 hours/day	Average showering/bathing time of 15 minutes per day (EPA, 1988b)
VAPOR INHALATION (SHOWERING)		
Based upon EPA guidance, the intake from the inhalation of vapors during showering is assumed to be equivalent to intake from the groundwater ingestion pathway (EPA, 1991a)		

Note: 1) For calculation purposes, some values for the child and adult in the residential scenario were normalized. Normalized values produce average doses over the period of exposure.

BW = (15.1 x 6/30) + (70 x 24/30) = 59 kg
SA = (7,280 x 6/30) + (19,400 x 24/30) = 17,000 cm^2 for showering/bathing exposure
Is = (200 x 6/30) + (100 x 24/30) = 120 mg/day
SA = (5,020 x 6/30) + (4,300 x 24/30) = 4,444 cm^2 for outdoor exposure

Table 4-8
Dermal Permeability Constants Used to Calculate Dermal Exposure to Chemicals in Groundwater at the Recticon/Allied Steel Site

Chemical	Dermal Permeability Constant (Kp)	
METALS		
Aluminum	1.00E-03	
Arsenic	1.00E-03	
Barium	1.00E-03	
Beryllium	1.00E-03	
Chromium	1.00E-03	
Cobalt	1.00E-03	
Copper	1.00E-03	
Manganese	1.00E-03	
Nickel	1.00E-03	
Vanadium	1.00E-03	
SVOCs		
Dimethylphthalate	1.60E-03	
TICs		
1,1,2-Trichloro-1,2,2-trifluoroethane	2.41E-02	(a)
Carbon Disulfide	2.40E-02	
tert-butylmethylether	1.45E-03	(a)
VOCs		
1,1,1-Trichloroethane	1.70E-02	
1,1,2-Trichloroethane	8.40E-03	
1,1-Dichloroethane	8.90E-03	
1,1-Dichloroethene	1.60E-02	
1,2,3-Trichlorobenzene	1.68E-01	(a)
1,2,4-Trimethylbenzene	4.78E-01	(a)
1,2-Dichloroethane	5.30E-03	
cis-1,2-Dichloroethene	1.00E-02	
trans-1,2-Dichloroethene	1.00E-02	
1,3-Dichlorobenzene	8.70E-02	
Benzene	2.10E-02	
Carbon Tetrachloride	2.20E-02	
Chlorobenzene	4.10E-02	
Chloroethane	8.00E-03	
Chloroform	8.90E-03	
Chloromethane	4.20E-03	
Dichlorodifluoromethane	1.20E-02	
Methylene Chloride	4.50E-03	
Tetrachloroethene	4.80E-02	
Trichloroethene	1.60E-02	
Trichlorofluoromethane	1.70E-02	
Vinyl Chloride	7.30E-03	
m,p-Xylene	8.00E-02	(b)

Table 4-8
Dermal Permeability Constants Used to Calculate Dermal Exposure to Chemicals in Groundwater at the Recticon/Allied Steel Site

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Kp values were obtained from EPA, 1992d unless otherwise noted.

(a) Kp was calculated as follows (as suggested in EPA, 1992d):

$$Kp = 10^{[(-2.72) + (0.71 \log Kow) - (0.0061 MW)]}$$

log Kow and MW were obtained from Table 4-4, or as follows:

	log Kow	MW
1,2,3-Trichlorobenzene	4.3	181.4
Trimethylbenzene (mixed isomers)	4.41	120

(Sources: EPA, 1986f; Strenge and Peterson, 1989; EPA, 1992c)

(b) Value for m-Xylene.

5.0 TOXICITY ASSESSMENT

The toxicity assessment collects and presents data on the relationship between the magnitude of exposure to a chemical and subsequent adverse health effects. This assessment provides, where possible, a numerical estimate of the increased likelihood and/or severity of adverse effects associated with chemical exposure (EPA, 1989a). For this assessment, the potential for chemicals to elicit adverse effects will be interpreted through the use of EPA-derived toxicity criteria. This section presents the source of the toxicity criteria and the use of surrogate values.

For purposes of the toxicity assessment, the chemicals of concern have been classified into two broad categories: non-carcinogens and carcinogens. This classification has been selected because health risks are quantified quite differently for carcinogenic and non-carcinogenic effects. Separate toxicity values have been developed by EPA for carcinogenic and non-carcinogenic effects that represent the potential magnitude of adverse health effects associated with exposure to chemicals. Toxicity studies with laboratory animals or epidemiological studies of human populations provide the data used to develop these toxicity values. The toxicity values are then combined with the exposure estimates (developed in Section 4.0) in the risk characterization process (Section 6.0) to estimate potential adverse effects of the chemicals of concern. Toxicity profiles for the chemicals of concern are presented in Attachment E.

Toxicity values used in the risk assessment were obtained from these sources:

- The Integrated Risk Information System (IRIS), a database available through the EPA Environmental Criteria and Assessments Office (ECAO) in Cincinnati, Ohio. IRIS, prepared and maintained by EPA, is an electronic database containing health risk and EPA regulatory information on specific chemicals (EPA, 1992a).

- The Health Effects Assessment Summary Tables (HEAST), provided by the EPA Office of Solid Waste and Emergency Response (OSWER) (EPA, 1991b; 1992b). HEAST is a compilation of toxicity values published in health effects documents issued by EPA. HEAST is for use in Superfund and RCRA programs.

Criteria obtained from IRIS are given priority over those from HEAST. If criteria are not available from either source, then one of the following procedures was used:

- Oral values were used to represent criteria for the inhalation or dermal pathways;
- Surrogate values were substituted for similar chemicals (*i.e.*, isomers); or
- Specific agency guidance was consulted.

For some chemicals without criteria (and without guidance from the Environmental Criteria and Assessment Office), it may not be appropriate to use surrogate values. In such cases, RAGS (1989a) recommends that the chemical be qualitatively evaluated. The implications of the absence of chemicals from the quantitative risk estimate will be addressed in the uncertainty section.

5.1 NON-CARCINOGENIC EFFECTS

Non-carcinogenic effects were evaluated using *reference doses* (RfDs) developed by EPA. The RfD is determined based on the assumption that thresholds exist for certain toxic effects (such as liver or kidney damage). In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) via the oral route of exposure that is likely to be without an appreciable risk of deleterious effects during a lifetime of exposure (EPA, 1989a). A corresponding value known as a *reference concentration* (RfC) is used to evaluate adverse effects from inhalation exposure (previously, the EPA presented these criteria as inhalation RfDs). RfDs and RfCs were obtained either from IRIS or HEAST. The RfDs (and RfCs converted to RfDs) for the chemicals of concern at the Site are presented in Table 5-1. RfCs were converted from concentrations (mg/m^3) to intake rates (mg/kg/day) by assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg.

5.2 CARCINOGENIC EFFECTS

Evidence of the carcinogenicity of a chemical comes from lifetime studies with laboratory animals and/or human epidemiologic studies. Unless evidence to the contrary exists, if a carcinogenic response occurs at the exposure levels studied (typically high doses), it is assumed that responses will occur at all lower doses (a linear extrapolation). Exposure to any level of a carcinogen is considered to have a finite risk of inducing cancer.

Because of the difficulties in quantifying risks at low levels of exposure in either animal or epidemiological studies, mathematical models are used to extrapolate from high to low doses. The linearized multi-stage model for low dose extrapolation is recommended by regulatory agencies for most chemicals (EPA, 1986a). Use of the linearized multi-stage model leads to a conservative upper-bound estimate of risk. The linearized multi-stage model incorporates a procedure for estimating the largest possible slope at low doses that is consistent with experimental dose-response data (use of a large slope tends to produce a higher estimate of cancer risk). The most sensitive species of animal is used for extrapolation to humans (*i.e.*, the assumption being that humans are as sensitive as the most sensitive animal species). The true risk is not likely to be higher than the estimate and is most likely lower (and could even be zero).

Numerical estimates of cancer potency are presented as *slope factors* (SFs). The slope factor defines the cancer risk due to continuous lifetime exposure to one unit of carcinogen (in units of risk per mg/kg/day). Individual cancer risk is calculated as the product of exposure to a chemical (in mg/kg/day) and the slope factor for that chemical (in mg/kg/day)$^{-1}$. Cancer risks from inhalation exposure to certain chemicals are characterized using *unit risk values* (URVs). The URV defines the cancer risk due to continuous lifetime exposure to one unit of carcinogen (in units of risk per $\mu g/m^3$ of air). URVs were converted to slope factors using the assumption of a 20 m^3/day inhalation rate and a 70 kg body weight. Cancer risks from exposure to multiple carcinogens and multiple pathways are assumed to be additive, based on the EPA carcinogen risk assessment guidelines (EPA, 1986a). Slope factors and URVs were obtained either from IRIS or HEAST.

Each slope factor or URV is accompanied by a weight-of-evidence classification. The weight-of-evidence classification indicates the likelihood that the chemical is a potential human carcinogen, and is based on the available data for a chemical. The evidence is characterized separately for studies in humans and studies in laboratory animals according to the groups listed below:

Weight of Evidence Group	Description
A	Human carcinogen
B1	Probable human carcinogen based on limited human data
B2	Probable human carcinogen based on sufficient evidence for carcinogenicity in animals and inadequate or no evidence of carcinogenicity in humans
C	Possible human carcinogen based on limited data for carcinogenicity in animals
D	Not classifiable as to human carcinogenicity
E	Evidence of non-carcinogenicity in humans

Source: EPA(1986a)

EPA recommends that cancer risk estimates should always be accompanied by a weight-of-evidence classification to indicate the strength of evidence that a chemical is a human carcinogen (EPA, 1986a; EPA, 1989a). The published and derived slope factors, URVs and accompanying weight-of-evidence classification for ingestion and inhalation exposures are presented in Table 5-1.

5.3 Chemicals without Existing Toxicity Values

Chemicals without RfDs or RfCs

Oral toxicity values are not available for many of the chemicals of concern at the Site. Although the intakes of these chemicals are calculated and presented, the adverse non-carcinogenic risks will only be considered qualitatively. Surrogate values using similar compounds were also used for selected chemicals. For example, the oral and inhalation RfDs for non-carcinogenic PAHs without values were

assumed to be equivalent to the values listed for fluoranthene because no criteria are available for many of the PAHs. Please see Table 5-1 for additional details.

Most of the chemicals of concern do not have RfC or inhalation RfD values. For chemicals lacking RfCs, oral RfDs were used to characterize noncancer effects associated with inhalation exposures to these chemicals. Chemicals without RfDs were considered qualitatively.

Chemicals without Slope Factors

According to IRIS, slope factors have been withdrawn or are pending for several carcinogenic compounds. In these cases, HEAST was consulted. These chemicals include:

- Carbon tetrachloride (inhalation only);
- Tetrachloroethene;
- Trichloroethene; and
- Vinyl chloride.

The values for these chemicals may have been withdrawn for a variety of reasons, but are typically withdrawn because of uncertainties associated with the study that require a re-evaluation of the derived value. For example, EPA has withdrawn the slope factors for TCE from IRIS (although the values are still published in HEAST). The withdrawn oral slope factor of 0.011 $(mg/kg/day)^{-1}$ was based on four sets of gavage bioassay data on hepatocellular carcinomas in male and female mice. The slope factor was the geometric mean calculated from metabolized doses in mice (EPA, 1985). The withdrawn inhalation slope factor of 0.017 $(mg/kg/day)^{-1}$ was calculated from four sets of mouse lung tumor data (EPA, 1987). According to IRIS, revised slope factors for this chemical are undergoing verification by EPA. While the slope factors have been withdrawn, IRIS still notes that TCE is a B2 carcinogen. Though still under review by EPA, the slope factors published in HEAST are used to characterize cancer risks associated with TCE. The uncertainties associated with using these slope factors are discussed further in Section 5.4 and Section 6.1.

Benzo(a)pyrene is the only carcinogenic PAH with a published slope factor. This value was used to quantify oral, dermal, and inhalation exposure for all carcinogenic PAHs. Inadequate ingestion and/or inhalation bioassay data exist for all other PAHs detected at the Site (except benzo[a]pyrene). Since benzo[a]pyrene has consistently been demonstrated to be one of the most potent carcinogenic PAHs, assuming that all PAHs are as potent as benzo[a]pyrene will greatly overestimate the carcinogenic risk for these compounds. To overcome this deficiency, ICF-Clement Associates developed Toxicity Equivalence Factors (TEFs) to rank the carcinogenic potency of other PAHs relative to benzo[a]pyrene (ICF-Clement, 1991). By multiplying the TEF of a particular PAH and the slope factor of benzo[a]pyrene, a slope factor for that PAH is obtained. The resultant product (a TEF-adjusted slope factor) is then used directly in the equations to estimate cancer risks. Table 5-2 presents the resultant TEF-based SFs for each carcinogenic PAH.

5.4 Uncertainties Related to Toxicity Information

Often, the analysis of uncertainties in health risk estimates has focused on the exposure assessment (*e.g.*, how much water an individual ingests or how long an individual may live near a site). However, as the assumptions used to evaluate the toxicity of chemicals, rather than exposure, may provide the greatest sources of uncertainty, the uncertainty associated with the exposure assumptions typically ranges from one to two orders of magnitude (10- to 100-fold). The extrapolation of cancer potency from laboratory animals to humans, which forms the basis for the cancer risk estimates presented in the risk assessment, may be associated with uncertainties ranging from three to five orders of magnitude (1,000- to 100,000-fold) for selected chemicals. Some of the uncertainties related to toxicity assessment include:

- Assumption that cancer risks are linearly related to exposure (*i.e.*, that carcinogenic effects have no thresholds).
- Assumption that exposure variables, and toxicity constants formulated for lifetime cancer risks are applicable for less than lifetime (subchronic) exposures.
- Inhalation slope factors for several chemicals were not available from IRIS or HEAST, but were calculated from URVs. In the IRIS profile for dichloromethane, EPA states:

Calculation of a slope factor from the unit risk is inappropriate when pharmacokinetic models are used. (When dose-response relationships are figured on the basis of internal or metabolized dose, a slope factor in terms of per (mg/kg)/day represents a back calculation using different absorption assumptions than the pharmacokinetic models. This introduces possible contradictions.)

Calculating inhalation slope factors from URVs may either underestimate or overestimate cancer risks for these chemicals.

- As discussed previously, the slope factors for several compounds have been withdrawn by EPA and are currently under review. At this time, it is not known how these values will change. Based on the available information, using the withdrawn slope factors may either overestimate or underestimate the risks associated with chemical exposure.

- Although evidence (Clement, 1988) suggests that PAHs have different carcinogenic potential, they were considered equivalent to benzo(a)pyrene. This is likely to result in an overestimate of cancer risk. In addition, the oral slope factor was used for the inhalation pathway which most likely overestimates risk. However, PAHs may be contact carcinogens via the dermal route. No criteria or methodology is widely accepted by regulatory agencies to address this issue. It, therefore, is a source of uncertainty that may underestimate risk.

Table 5-1
Toxicity Criteria for Chemicals of Concern at the Recticon/Allied Steel Site

Chemical	Non-carcinogenic Effects Chronic Reference Dose (RfD)		Carcinogenic Effects Slope Factor (SF)			
	Oral (mg/kg/day)	Inhalation (mg/kg/day)	Oral (mg/kg/day)^-1	Group*	Inhalation (mg/kg/day)^-1	Group*
METALS						
Aluminum (a)	DI	DI	--	--	--	--
Antimony	0.0004	ND (b)	--	--	--	--
Arsenic	0.0003	ND (b)	1.75 (b)	--	15 (c)	A
Barium	0.07	0.0001 (d)	--	--	--	--
Beryllium	0.005	ND (b)	4.3	B2	8.4 (e)	B2
Cadmium	0.0005	P	--	--	6.3 (f)	B1
Chromium III	1	5.7 E-7 (g)	--	--	--	--
Cobalt	P	--	--	--	--	--
Copper	0.037 (h)	ND (b)	--	D	--	D
Lead	(i)	(i)	--	B2	--	B2
Manganese	0.1	0.00011	--	D	--	D
Mercury (d)	0.0003	0.000086 (j)	--	D	--	D
Nickel	0.02 (b)	ND (b)	--	A	0.84 (k)	A
Selenium	0.005	--	--	D	--	D
Silver	0.005	ND (b)	--	D	--	D
Thallium	0.00009	ND (b)	--	D	--	D
Vanadium	0.007 (a)	--	--	--	--	--
Zinc	0.2 (d)	P	--	D	--	D
PAHs						
2-Methylnaphthalene (l)	0.04	--	ND	--	ND	--
Acenaphthylene (b)	DI	DI	--	--	--	--
Anthracene	0.3	ND	--	D	--	D
Benzo(a)Anthracene (m)	--	--	ND	B2	ND	B2
Benzo(a)Pyrene	--	--	7.3	B2	6.1 (a)	B2
Benzo(b)Fluoranthene (m)	--	--	ND	B2	ND	B2
Benzo(g,h,i)Perylene (l)	0.04	--	ND	--	ND	--
Benzo(k)Fluoranthene (m)	--	--	ND	B2	ND	B2
Chrysene (m)	--	--	ND	B2	ND	B2
Dibenzo(a,h)Anthracene (m)	--	--	ND	B2	ND	B2
Dibenzofuran (i)	0.04	P	ND	D	ND	D

Table 5-1
Toxicity Criteria for Chemicals of Concern at the Recticon/Allied Steel Site

Chemical	Non-carcinogenic Effects Chronic Reference Dose (RfD)		Carcinogenic Effects Slope Factor (SF)			
	Oral (mg/kg/day)	Inhalation (mg/kg/day)	Oral (mg/kg/day)^-1	Group*	Inhalation (mg/kg/day)^-1	Group*
Fluoranthene	0.04	--	ND	D	ND	D
Fluorene	0.04	--	ND	D	ND	D
Indeno(1,2,3-cd)Pyrene (m)	--	--	--	B2	--	B2
Naphthalene (l)	0.04	--	ND	D	ND	D
Phenanthrene (l)	0.04	--	ND	D	ND	D
Pyrene	0.03	--	ND	D	ND	D
SVOCs						
Benzoic Acid	4	--	ND	D	ND	D
bis(2-ethylhexyl)phthalate	0.02	--	0.014	--	ND	--
Butylbenzylphthalate	0.2 (b)	ND (b)	--	D	--	D
Di-n-butylphthalate	0.1	DI	ND	B2	ND	B2
Dimethylphthalate	1 (d)	DI	ND	D	ND	D
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethane	30	P	--	--	--	--
Carbon Disulfide	0.1	0.1 (d)	--	--	--	--
tert-butylmethylether	--	--	--	--	--	--
VOCs						
1,1,1-Trichloroethane	0.09 (d)	0.3 (n)	ND	D	ND	D
1,1,2-Trichloroethane	0.004	P	0.057	C	0.056	C
Trichloroethane (total) (o)	0.004	P	0.057	C	0.056	C
1,1-Dichloroethane	0.1 (d)	0.1 (d)	ND	C	ND	C
1,1-Dichloroethene	0.009	ND	0.6	C	0.175 (p)	C
1,2,3-Trichlorobenzene (q)	0.01	0.003 (b)	ND	D	ND	D
1,2,4-Trichlorobenzene	0.01 (r)	0.003 (b)	ND	D	ND	D
1,2,4-Trimethylbenzene (b)	DI	DI	--	--	--	--
1,2-Dichlorobenzene	0.09	0.04 (b)	ND	D	ND	D
1,2-Dichloroethane	--	--	0.091	B2	0.091	B2
cis-1,2-Dichloroethene	0.01 (d)	ND	--	D	--	D
trans-1,2-Dichloroethene (b)	0.02	[illegible] (b)	--	--	--	--

Table 5-1
Toxicity Criteria for Chemicals of Concern at the Recticon/Allied Steel Site

Chemical	Non-carcinogenic Effects Chronic Reference Dose (RfD)		Carcinogenic Effects Slope Factor (SF)			
	Oral (mg/kg/day)	Inhalation (mg/kg/day)	Oral (mg/kg/day)^-1	Group*	Inhalation (mg/kg/day)^-1	Group*
1,2-Dichloroethene (total) (s)	0.02	--	--	--	--	--
1,3-Dichlorobenzene (t)	0.09	0.04 (b)	ND	D	ND	D
Acetone	0.1	--	--	D	--	D
Benzene	P	P	0.029	A	0.029	A
Carbon Tetrachloride	0.0007	ND	0.13	B2	0.13 (b)	B2
Chlorobenzene	0.02	0.005 (d)	ND	D	ND	D
Chloroethane	--	--	--	--	--	--
Chloroform	0.01	P	0.0061	B2	0.08 (v)	B2
Chloromethane	P	P	0.013 (a)	C	0.0063 (a)	C
Dichlorodifluoromethane	0.2	0.05 (b)	--	--	--	--
Ethylbenzene	0.1	0.28	ND	D	ND	D
Methylene Chloride	0.06	0.86 (w)	0.0075	B2	0.0016 (x)	B2
Tetrachloroethene	0.01	ND	0.051 (d)	B2	0.018 (d)	B2
Toluene	0.2	0.57 (y)	ND	D	ND	D
Trichloroethene	P	P	0.011 (n)	B2 (n)	0.017 (n)	B2 (n)
Trichlorofluoromethane	0.3	0.2 (b)	--	--	--	--
Vinyl Chloride	--	--	1.9 (d)	A	0.29 (d)	A
Xylenes	2	0.086 (z)	ND	D	ND	D

All data obtained from IRIS (September, 1992) unless otherwise noted.

* EPA rates chemical carcinogenicity on a weight-of-evidence classification system where:

Group A- Human carcinogen
Group B1- Probable human carcinogen (based on limited human data)
Group B2- Probable human carcinogen (based on sufficient evidence in animals)
Group C- Possible human carcinogen
Group D- Not classifiable as to human carcinogenicity

DI - Data inadequate for derivation of value -- Data not available P - Value pending ND - Not determined

(a) Data obtained from HEAST (EPA, 1992b).
(b) Values obtained from 1991 HEAST (EPA, 1991b).

Table 5-1
Toxicity Criteria for Chemicals of Concern at the Recticon/Allied Steel Site

(c) Derived from inhalation unit risk of 4.3 E-3 (ug/m^3).
(d) Value pending from IRIS; therefore, value obtained from HEAST (EPA, 1991b).
(e) Derived from inhalation unit risk of 2.4 E-3 (ug/m^3).
(f) Derived from inhalation unit risk of 1.8 E-3 (ug/m^3)
(g) Value calculated from a reference concentration of 2.0 E-6 (mg/m^3) from HEAST (EPA, 1991b).
(h) Value calculated from a reference concentration of 1.3 (mg/L) from HEAST (EPA, 1991b).
(i) EPA's RfD work group determined that it is inappropriate to develop a RfD for lead.
(j) Value calculated from a reference concentration of 3.0 E-4 (mg/m^3) from HEAST (EPA, 1991b).
(k) Values for nickel as refinery dust.
(l) Non-carcinogenic health criteria for Fluorene were used as a surrogate since data for this chemical were not available from IRIS or HEAST.
(m) Carcinogenic health criteria for this chemical were not available from IRIS or HEAST. See Table 5-2 for surogate values.
(n) Value withdrawn from IRIS; therefore, value obtained from HEAST (EPA, 1991b).
(o) Values were conservatively assumed to be the same as 1,1,2-Trichloroethane.
(p) Derived from inhalation unit risk of 5.0 E-5 (ug/m^3).
(q) Data not available for this compound. Substitued values of 1,2,4-Trichlorobenzene as surrogate.
(r) Value obtained from HEAST (EPA, 1992b). However, a Critical Dose of 14.8 mg/kg/day was listed in IRIS.
(s) Data not available for this compound. Substitued values of trans-1,2-Dichloroethene as surrogate.
(t) No data available; used 1,2-Dichlorobenzene as surrogate.
(u) Value calculated from a reference concentration of 0.7 (mg/m^3) from HEAST (EPA, 1992b).
(v) Derived from inhalation unit risk of 2.3 E-5 (ug/m^3).
(w) Value calculated from a reference concentration of 3.0 (mg/m^3) from HEAST (EPA, 1991b).
(x) Derived from inhalation unit risk of 4.7 E-7 (ug/m^3)
(y) Value calculated from a reference concentration of 2.0 (mg/m^3) from HEAST (EPA, 1991b).
(z) Value calculated from a reference concentration of 0.3(mg/m^3) from HEAST (EPA, 1991b).

Table 5-2
Toxicity Criteria Used to Evaluate Carcinogenic PAHs Based on Toxicity Equivalency Factors* (TEFs) at the Recticon/Allied Steel Site

Carcinogenic PAH	TEF	Oral Route		Inhalation Route	
		Slope Factor (SF) Benzo(a)Pyrene (mg/kg/day)^-1	TEF-Based Slope Factor (SF) (mg/kg/day)^-1	Slope Factor (SF) Benzo(a)Pyrene (mg/kg/day)^-1	TEF-Based Slope Factor (SF) (mg/kg/day)^-1
Benzo(a)Anthracene	0.145	7.3	1.1	6.1	0.88
Benzo(b)Fluoranthene	0.167	7.3	1.2	6.1	1.0
Benzo(g,h,i)Perylene	0.015	7.3	0.11	6.1	0.092
Benzo(k)Fluoranthene	0.02	7.3	0.15	6.1	0.12
Chrysene	0.0044	7.3	0.032	6.1	0.027
Dibenzo(a,h)Anthracene	1.11	7.3	8.1	6.1	6.8
Indeno(1,2,3-cd)Pyrene	0.021	7.3	0.15	6.1	0.13

* Rational describing the TEF approach is listed in Section 5.3 of the text.

6.0 RISK CHARACTERIZATION

Risk characterization provides a quantitative description of the magnitude of potential health concerns related to chemicals detected at a site. It involves combining the results of the exposure and toxicity assessments to provide numerical estimates of non-carcinogenic and carcinogenic health risk. The results of the quantitative assessment will be integrated with other pertinent information (*i.e.*, land use considerations, environmental fate and transport, etc.) to provide a perspective on health issues pertaining to the Site.

6.1 UNCERTAINTY ANALYSIS

An important component of the risk assessment process is the discussion of the uncertainties associated with the assumptions and methodology employed in the analysis. Some of the uncertainties are noted below.

Data Collection/Data Evaluation

Representative Concentrations

- The values used for the chemical concentration in suspended particulates are based on measured soil concentrations and local PM_{10} data, while the concentrations of chemical vapors in air are based on the results from mathematical models. General assumptions are made to estimate the concentration of chemicals in particulates, namely that the suspended particulate matter less than 10 microns emanating from the site is similar to measured PM_{10} data.

- Chemical vapor concentrations are based on modeled results using default values.

- Several chemicals were evaluated that may have false positives. For example, bis(2-ethylhexyl)phthalate and carbon tetrachloride may have been detected as a result of laboratory contamination. Conversely, some chemicals were identified as potential false negatives or biased low. However, these are not likely to contribute greatly to uncertainties with the risk assessment (see Section 3.1).

- The risks associated with PAHs detected on the Site were calculated, but these chemicals may not be related to the Site.

- Only limited surface soil samples (in the drainage ditch area) were collected as part of the RI.

- The 95% UCLs of groundwater concentrations were used for most exposure scenarios which should produce health-conservative estimates; however, no assessment of the future migration of chemicals was made.

Exposure Assumptions

- Several assumptions were made regarding the length of time an individual spends on the Site. These assumptions tend to overestimate the length of time for contact (*e.g.*, 350 days/year, 24 hours/day, 30 years). Assumptions on ingestion, inhalation, and dermal contact rates are typically used by risk assessors and reflect upper-bound estimates for these activities, to avoid underestimation of chemical exposure and consequent risks.

- Recent information obtained from EPA indicates that methods for assessing dermal exposure are undergoing review and revision. Recently, the EPA Exposure Assessment Branch has stated that the qualitative approach is, for many compounds, more appropriate than quantification for dermal exposures. The EPA recommends using the assumption that dermal contact with SVOCs and metals in soil may present comparable risks to soil ingestion (Schaum, 1991). Therefore, health risks from dermal exposure may be overestimated by two- to three-fold.

- The intake via the inhalation of vapors while showering was considered equivalent to groundwater ingestion. This introduces considerable uncertainty for this pathway.

Vapor Emissions Model

- Uncertainties associated with the vapor models are discussed in Section 4.3. In order to assess the accuracy of the Farmer emission model, soil gas TCE samples (measured concentrations) from both facilities were compared to the model-predicted concentrations derived from groundwater TCE samples.

  According to model results, soil gas TCE concentration was 101 mg/m^3, where the maximum detected TCE concentrations from the Recticon and Allied Steel facilities were 6.0 and 0.3 mg/m^3, respectively. The model-predicted soil gas concentration was approximately 17 to 1,000 greater than maximum concentration detected at the Recticon and Allied Steel facilities. While not intended as a field calibration of the model, this information suggests that TCE concentrations in air may be overestimates of the actual concentration.

Toxicity Extrapolations

- Toxicity criteria for many compounds are based on animal studies. Since the chemical concentrations that humans encounter in the environment are usually much lower than those used in laboratory studies, a level of uncertainty is introduced in using animal toxicity data. To compensate for the range of possible values in the extrapolation from animals to humans, and from high to low doses, health-protective assumptions are made to ensure that adverse health effects in humans are not underestimated. Thus, the toxicity criteria tend to overestimate the magnitude of the potential adverse health effects associated with a given exposure to a particular chemical.

- The EPA has not derived health criteria based on dermal absorption. Intake rates for ingestion and inhalation routes of exposure are based on the intake of chemicals by laboratory animals in food, drinking water, test solutions, or air. However, chemical intake from dermal exposure is calculated in terms of absorption, so toxicity values must be converted to units of absorbed dose in order to avoid underestimation of health risks from the dermal exposure pathways. This conversion was not performed in this risk assessment.

- A drawback to current risk assessment methodology is that cancer risks for multiple substances are summed equally, giving as much weight to class B or C as to class A carcinogens.

6.2 Quantification of Health Risks

This section describes the general procedures for applying the toxicity criteria presented in Section 5.0 to the intakes calculated using the methods described in Section 4.0.

6.2.1 Non-carcinogenic Risks

The potential for chronic non-carcinogenic health effects can be evaluated using the RfD for each chemical. As described in the previous section, RfDs are average daily doses that are not expected to produce adverse effects. The estimated intake of a chemical for a particular pathway can be compared mathematically to the ratio of the ADD and the RfD; this ratio is referred to as the *hazard quotient*.

$$Hazard\ Quotient = \frac{ADD}{RfD} \quad (19)$$

Hazard quotients less than one indicate that the predicted exposures are acceptable by the EPA. These hazard quotients may be grouped on the basis of critical effect and summed to provide a *hazard index*. Because the quotients are summed, the hazard index can exceed one even if no single chemical exposure exceeds its acceptable exposure level. As a screening procedure, all of the hazard quotients for a particular pathway and scenario were summed with the understanding that if the sum exceeded one, then hazard quotients would be grouped and summed by critical effect.

6.2.2 CARCINOGENIC RISKS

Carcinogenic risks are defined as the probability of an individual developing cancer as the result of a specific exposure to a given chemical. The cancer risk associated with the LADD can be calculated from:

$$Risk = LADD \times SF \quad (20)$$

where,

Risk	=	Noncumulative cancer risk
LADD	=	Lifetime Average Daily Dose (mg/kg/day)
SF	=	SF $(mg/kg/day)^{-1}$

The risks associated with individual chemicals can be summed over the considered pathways to produce a cumulative estimate. The EPA interprets the results of the carcinogenic risk characterization in the following way:

Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1×10^{-4}, and the non-carcinogenic hazard quotient is less than 1, [remedial] action generally is not warranted. (EPA, 1991c).

6.3 RESULTS OF RISK CALCULATIONS

This section presents the numerical results of the risk assessment. Health risks have been estimated for the following potentially exposed populations:

- Current trespasser;
- Current offsite resident;
- Future onsite worker; and
- Future onsite resident.

These scenarios were examined under RME assumptions. The intakes and associated risks are presented in Tables 6-1 to 6-26. Note that risks from vapor inhalation were calculated separately for the Recticon and Allied Steel facilities. The results of both calculations are presented, but only the results of the Recticon facility (as it produced the highest estimates) were used for cumulative risk estimates.

6.3.1 CURRENT ONSITE TRESPASSER SCENARIO

For non-carcinogenic effects, no hazard quotients exceeded regulatory criteria for this scenario. PAHs yielded the largest contribution among the chemicals of concern. Dermal contact contributed the greatest amount to carcinogenic risk, but the total risk from all pathways was less than 1×10^{-6}.

6.3.2 CURRENT OFFSITE RESIDENT

Two pathways were quantified for this pathway: the inhalation of vapors (originating from groundwater), and the ingestion of groundwater. No chemicals exceeded regulatory criteria for non-carcinogenic effects, and the total cancer risk associated with this pathway was less than 1×10^{-6}. Since the samples used to quantify risks were collected from 16 unfiltered drinking water wells, they are more

representative of potential exposure. If the pre-filtration samples are examined for the 6 wells with carbon filtration, these risks would be comparable to the risks associated with the future on-site resident. Although this scenario assessed the risks for current (and future) offsite residents, the exposure concentrations used were intended to provide an upper-bound estimate of risk. Actual exposure at the levels considered may not be possible since groundwater used by residents is monitored and/or filtered. The concentrations used in the risk calculations were based on the highest detections in groundwater samples collected from this monitoring program. The results of the monitoring program indicate that chemicals are at or below detection limits. The exposure concentrations in air were based on emissions modeling of the 95% UCLs of groundwater concentrations found on the Site. Since the majority of groundwater contamination is still present on the Site, this approach also produces an overestimate of risk.

6.3.3 FUTURE ONSITE WORKER SCENARIO

Under the screening approach for non-carcinogenic effects, several compounds contributed to a hazard index of greater than one for the groundwater ingestion pathway. Therefore, the hazard index was calculated based on particular critical effects (see Section 6.4). When divided on the basis of critical effect, no hazard indices exceeded one; therefore, no adverse non-carcinogenic effects are expected for the exposures examined. The groundwater ingestion pathway contributed the most to total risk, although the dermal contact (with soil) pathway also exceeded 1×10^{-6}. TCE contributed the greatest amount to risk via this pathway. A more detailed analysis of the risks associated with this scenario is presented in Section 6.4.

6.3.4 FUTURE ONSITE RESIDENT SCENARIO

Cis-1,2-dichloroethene exceeded the RfD in the groundwater ingestion pathway; therefore, hazard indices were examined by critical effect (please see Section 6.3). Among carcinogens, TCE produced the highest risk estimates. For VOCs, it was assumed that the intake via vapor inhalation was equivalent to groundwater ingestion; therefore, the risks are somewhat similar for the two pathways. TCE in groundwater contributed the most to total risk. Dermal contact with soil and groundwater (showering) both exceeded 1×10^{-6} risk.

6.4 ANALYSIS OF RISK ESTIMATES

The risk characterization section serves as a bridge between risk assessment and risk management. While the numerical values presented in the last section are critical components of a risk assessment, other pertinent factors influence these risk estimates, and the subsequent management of these risks. This section analyzes the non-carcinogenic and carcinogenic risks in terms of pertinent site-specific condition. This section will focus on the future onsite worker and resident scenario, since the trespasser and offsite resident scenarios produced relatively low risks. (Please refer to the summary tables presented in Attachment F for details on the contribution of risks associated with the Site.)

6.4.1 NON-CARCINOGENIC EFFECTS

As mentioned earlier, a screening procedure was used to evaluate non-carcinogenic effects:

- All hazard quotients for a particular pathway were summed, if the resulting screening hazard index exceeded one; then
- Hazard indices were calculated for each target organ (and all pathways) for chemicals that had hazard quotients greater than 0.001 in a particular medium (see Attachment E).

The screening hazard indices were exceeded in the future onsite worker and residential scenarios for groundwater pathways. Hazard indices were calculated by critical effect for the future onsite worker and resident scenarios. The target organs and critical effects for chemicals in soil, air, or groundwater that exceeded a hazard quotient of 0.001 are presented in Table 6-27.

Tables 6-28 and 6-29 present the hazard index based on critical effect for the future onsite worker and resident scenarios. In both scenarios, *cis*-1,2-dichloroethene produced (by far) the highest hazard quotients. No hazard indices were exceeded in the worker scenario. The hazard index, based on blood effects as a target, was exceeded in the onsite resident scenario.

6.4.2 CARCINOGENIC EFFECTS

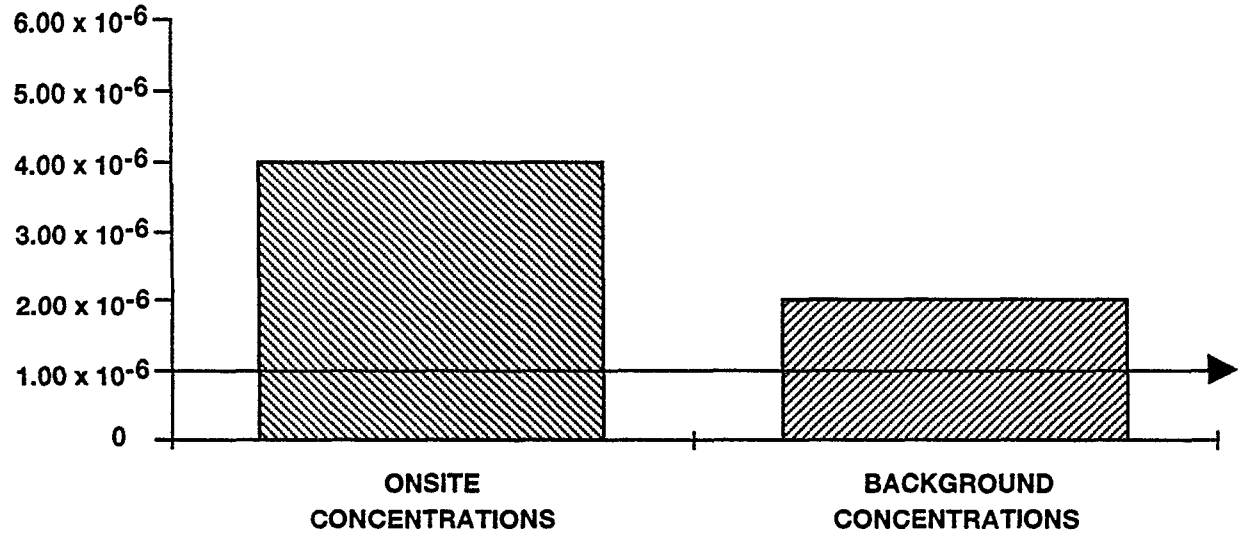
The cumulative cancer risks associated with the scenarios considered are summarized in Table 6-30. Several factors that influence the interpretation of these risks are listed below.

Groundwater exposure

The groundwater pathways contributed the greatest amount to total cancer risks; however, the potential for exposure may not be very likely. Groundwater wells in the vicinity of the Site are monitored and/or have had filtration systems installed to remove chemicals from water. Monitoring and/or filtration of domestic water wells used on the Site are likely to reduce the risk estimates presented in this assessment, depending on the effectiveness of the program.

Consideration of Background Concentrations for Soil Exposure

Among soil pathways, the risk from dermal contact was greater than soil ingestion, and was at least an order of magnitude greater than particulate inhalation for both the onsite worker and onsite resident scenarios. These risks are based on soil samples from limited areas of the Site. Most of the risk from all soil pathways originated from the carcinogenic PAHs. Nickel and *bis*(2-ethylhexyl)phthalate registered the next highest non-PAH risk estimates for the residential scenario, both at approximately 1.5×10^{-10}. However, PAHs may not be associated with onsite activities and may instead be related to automobile exhaust or other anthropogenic sources. Two samples (SS-3 and SS-7) were collected upgradient of both facilities and the concentrations of these samples appear to be roughly comparable with onsite concentrations. To illustrate the influence that potentially non-site related PAHs may have on cancer risk estimates, the risks associated with background sample SS-3 was calculated. Figure 6-1 presents this comparison under the same assumptions as the future onsite resident scenario. Both concentrations produce risks in excess of 1×10^{-6}.



COMPARISON OF CARCINOGENIC RISKS (Residential Scenario) ASSOCIATED WITH PAHs IN BACKGROUND AND ONSITE SAMPLES

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032.PAHs.1

FIGURE 6-1

Consideration of Potential Background Levels in Groundwater

The consideration of background concentrations may also apply to groundwater. For example, other than TCE, beryllium and arsenic produced the next greatest cancer risks. However, based on the site history, organic substances are thought to have been of greatest concern on the Site. The concentrations of these metals may reflect naturally occurring background levels.

Dominant Chemicals

Table 6-30 also ranks the compounds that produced the highest risks. If contact with soil was the dominant pathway for a chemical, then PAHs were the dominant chemicals. In groundwater, TCE contributed the greatest amount to risk, followed distantly by beryllium and arsenic. If PAHs, beryllium, and arsenic were excluded from the assessment based on background concentrations, the risks in the dermal (soil) pathway would drop by an order of magnitude; however, exclusion of beryllium and arsenic would have little effect on the risks associated with groundwater.

Table 6-1
TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE CURRENT TRESPASSER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Dermal Contact							
METALS							
Chromium	80.7	9.32E-07	1	9.32E-07	1.06E-07	-	NA
Copper	211	2.44E-06	0.037	6.58E-05	2.78E-07	-	NA
Lead	151	1.74E-06	-	NA	1.99E-07	-	NA
Nickel	28.7	3.31E-07	0.02	1.66E-05	3.79E-08	-	NA
Zinc	772	8.91E-06	0.2	4.46E-05	1.02E-06	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.05E-07	0.04	2.63E-06	1.20E-08	-	NA
Acenaphthylene	0.33	4.95E-08	-	NA	5.66E-09	-	NA
Anthracene	0.32	4.80E-08	0.3	1.60E-07	5.49E-09	-	NA
Benzo(a)anthracene	1	1.50E-07	-	NA	1.72E-08	1.1	1.89E-08
Benzo(a)pyrene	1.2	1.80E-07	-	NA	2.06E-08	7.3	1.50E-07
Benzo(b)fluoranthene	2	3.00E-07	-	NA	3.43E-08	1.2	4.12E-08
Benzo(g,h,i)perylene	0.81	1.22E-07	0.04	3.04E-06	1.39E-08	0.11	1.53E-09
Benzo(k)fluoranthene	0.95	1.43E-07	-	NA	1.63E-08	0.15	2.44E-09
Chrysene	1	1.50E-07	-	NA	1.72E-08	0.032	5.49E-10
Dibenz(a,h)anthracene	0.23	3.45E-08	-	NA	3.94E-09	8.1	3.20E-08
Dibenzofuran	0.3	4.50E-08	0.04	1.13E-06	5.15E-09	-	NA
Fluoranthene	1.6	2.40E-07	0.04	6.00E-06	2.74E-08	-	NA
Fluorene	0.12	1.80E-08	0.04	4.50E-07	2.06E-09	-	NA
Indeno(1,2,3-cd)pyrene	1.1	1.65E-07	-	NA	1.89E-08	0.15	2.83E-09
Naphthalene	0.4	6.00E-08	0.04	1.50E-06	6.86E-09	-	NA
Phenanthrene	1.6	2.40E-07	0.04	6.00E-06	2.74E-08	-	NA
Pyrene	1.6	2.40E-07	0.03	8.00E-06	2.74E-08	-	NA
SVOCs							
Benzoic Acid	0.26	3.00E-08	4	7.50E-09	3.43E-09	-	NA
bis(2-ethylhexyl)phthalate	0.93	1.07E-07	0.02	5.37E-06	1.23E-08	0.014	1.72E-10
Butylbenzylphthalate	0.39	4.50E-08	0.2	2.25E-07	5.15E-09	-	NA
Di-n-butylphthalate	0.099	1.14E-08	0.1	1.14E-07	1.31E-09	-	NA
VOCs							
Acetone	0.14	4.04E-08	0.1	4.04E-07	4.62E-09	-	NA
Trichloroethene	0.005	1.44E-09	-	NA	1.65E-10	0.011	1.81E-12
			Hazard Index:	**<0.001**		**Total Risk:**	**2 E-07**

ADD = [redacted]ge Daily Dose
RfD = [redacted]nce Dose
Hazard Quotient = ADD / RfD

LADD = L[redacted] Average Daily Dose
SF = Carci[redacted]ic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

[redacted]

Table 6-2
TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE CURRENT TRESPASSER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)$^{-1}$	CARCINOGENIC RISK
Soil Ingestion							
METALS							
Chromium	80.7	2.27E-06	1	2.27E-06	2.60E-07	-	NA
Copper	211	5.94E-06	0.037	1.61E-04	6.79E-07	-	NA
Lead	151	4.25E-06	-	NA	4.86E-07	-	NA
Nickel	28.7	8.08E-07	0.02	4.04E-05	9.23E-08	-	NA
Zinc	772	2.17E-05	0.2	1.09E-04	2.48E-06	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.97E-08	0.04	4.93E-07	2.25E-09	-	NA
Acenaphthylene	0.33	9.29E-09	-	NA	1.06E-09	-	NA
Anthracene	0.32	9.01E-09	0.3	3.00E-08	1.03E-09	-	NA
Benzo(a)anthracene	1	2.82E-08	-	NA	3.22E-09	1.1	3.54E-09
Benzo(a)pyrene	1.2	3.38E-08	-	NA	3.86E-09	7.3	2.82E-08
Benzo(b)fluoranthene	2	5.63E-08	-	NA	6.44E-09	1.2	7.72E-09
Benzo(g,h,i)perylene	0.81	2.28E-08	0.04	5.70E-07	2.61E-09	0.11	2.87E-10
Benzo(k)fluoranthene	0.95	2.67E-08	-	NA	3.06E-09	0.15	4.59E-10
Chrysene	1	2.82E-08	-	NA	3.22E-09	0.032	1.03E-10
Dibenz(a,h)anthracene	0.23	6.48E-09	-	NA	7.40E-10	8.1	5.99E-09
Dibenzofuran	0.3	8.45E-09	0.04	2.11E-07	9.65E-10	-	NA
Fluoranthene	1.6	4.50E-08	0.04	1.13E-06	5.15E-09	-	NA
Fluorene	0.12	3.38E-09	0.04	8.45E-08	3.86E-10	-	NA
Indeno(1,2,3-cd)pyrene	1.1	3.10E-08	-	NA	3.54E-09	0.15	5.31E-10
Naphthalene	0.4	1.13E-08	0.04	2.82E-07	1.29E-09	-	NA
Phenanthrene	1.6	4.50E-08	0.04	1.13E-06	5.15E-09	-	NA
Pyrene	1.6	4.50E-08	0.03	1.50E-06	5.15E-09	-	NA
SVOCs							
Benzoic Acid	0.26	7.32E-09	4	1.83E-09	8.37E-10	-	NA
bis(2-ethylhexyl)phthalate	0.93	2.62E-08	0.02	1.31E-06	2.99E-09	0.014	4.19E-11
Butylbenzylphthalate	0.39	1.10E-08	0.2	5.49E-08	1.25E-09	-	NA
Di-n-butylphthalate	0.099	2.79E-09	0.1	2.79E-08	3.19E-10	-	NA
VOCs							
Acetone	0.14	3.94E-09	0.1	3.94E-08	4.50E-10	-	NA
Trichloroethene	0.005	1.41E-10	-	NA	1.61E-11	0.011	1.77E-13
			Hazard Index:	**<0.001**		**Total Risk:**	**5 E-08**

ADD = Average Daily Dose
RfD = Reference Dose
LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-3
TOTAL INTAKE AND RISKS FROM PARTICULATE INHALATION OF SOIL IN THE CURRENT TRESPASSER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Particulate Inhalation							
METALS							
Chromium	80.7	2.04E-09	0.00000057	3.57E-03	2.33E-10	-	NA
Copper	211	5.33E-09	0.037	1.44E-07	6.09E-10	-	NA
Lead	151	3.81E-09	-	NA	4.36E-10	-	NA
Nickel	28.7	7.24E-10	0.02	3.62E-08	8.28E-11	0.84	6.95E-11
Zinc	772	1.95E-08	0.2	9.74E-08	2.23E-09	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.77E-11	0.04	4.42E-10	2.02E-12	-	NA
Acenaphthylene	0.33	8.33E-12	-	NA	9.52E-13	-	NA
Anthracene	0.32	8.08E-12	0.3	2.69E-11	9.23E-13	-	NA
Benzo(a)anthracene	1	2.52E-11	-	NA	2.88E-12	0.88	2.54E-12
Benzo(a)pyrene	1.2	3.03E-11	-	NA	3.46E-12	6.1	2.11E-11
Benzo(b)fluoranthene	2	5.05E-11	-	NA	5.77E-12	1	5.77E-12
Benzo(g,h,i)perylene	0.81	2.04E-11	0.04	5.11E-10	2.34E-12	0.092	2.15E-13
Benzo(k)fluoranthene	0.95	2.40E-11	-	NA	2.74E-12	0.12	3.29E-13
Chrysene	1	2.52E-11	-	NA	2.88E-12	0.027	7.79E-14
Dibenz(a,h)anthracene	0.23	5.80E-12	-	NA	6.63E-13	6.8	4.51E-12
Dibenzofuran	0.3	7.57E-12	0.04	1.89E-10	8.65E-13	-	NA
Fluoranthene	1.6	4.04E-11	0.04	1.01E-09	4.62E-12	-	NA
Fluorene	0.12	3.03E-12	0.04	7.57E-11	3.46E-13	-	NA
Indeno(1,2,3-cd)pyrene	1.1	2.78E-11	-	NA	3.17E-12	0.13	4.12E-13
Naphthalene	0.4	1.01E-11	0.04	2.52E-10	1.15E-12	-	NA
Phenanthrene	1.6	4.04E-11	0.04	1.01E-09	4.62E-12	-	NA
Pyrene	1.6	4.04E-11	0.03	1.35E-09	4.62E-12	-	NA
SVOCs							
Benzoic Acid	0.26	6.56E-12	4	1.64E-12	7.50E-13	-	NA
bis(2-ethylhexyl)phthalate	0.93	2.35E-11	0.02	1.17E-09	2.68E-12	-	NA
Butylbenzylphthalate	0.39	9.84E-12	0.2	4.92E-11	1.12E-12	-	NA
Di-n-butylphthalate	0.099	2.50E-12	0.1	2.50E-11	2.86E-13	-	NA
VOCs							
Acetone	0.14	3.53E-12	0.1	3.53E-11	4.04E-13	-	NA
Trichloroethene	0.005	1.26E-13	-	NA	1.44E-14	0.017	2.45E-16
			Hazard Index:	4 E-03		**Total Risk:**	1 E-10

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-4
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE CURRENT TRESPASSER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	3.15E-10	5.89E-12	4	1.47E-12	6.74E-13	-	NA
bis(2-ethylhexyl)phthalate	1.47E-10	2.75E-12	0.02	1.38E-10	3.14E-13	-	NA
Di-n-butylphthalate	1.42E-13	2.65E-15	0.1	2.65E-14	3.03E-16	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	2.77E-08	30	9.22E-10	3.16E-09	-	NA
tert-butylmethylether	1.27E-09	2.36E-11	-	NA	2.70E-12	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	7.71E-10	0.3	2.57E-09	8.81E-11	-	NA
Trichloroethane (total)	1.29E-08	2.41E-10	0.004	6.02E-08	2.75E-11	0.056	1.54E-12
1,1-Dichloroethane	2.54E-08	4.75E-10	0.1	4.75E-09	5.43E-11	-	NA
1,1-Dichloroethene	2.03E-08	3.80E-10	0.009	4.22E-08	4.34E-11	0.175	7.60E-12
1,2-Dichloroethane	5.19E-09	9.71E-11	-	NA	1.11E-11	0.091	1.01E-12
cis-1,2-Dichloroethene	6.59E-07	1.23E-08	0.01	1.23E-06	1.41E-09	-	NA
trans-1,2-Dichloroethene	2.97E-09	5.55E-11	0.02	2.78E-09	6.34E-12	-	NA
1,2-Dichloroethene (total)	5.40E-06	1.01E-07	0.02	5.04E-06	1.15E-08	-	NA
Acetone	1.30E-06	2.43E-08	0.1	2.43E-07	2.78E-09	-	NA
Benzene	3.23E-09	6.04E-11	-	NA	6.91E-12	0.029	2.00E-13
Carbon Tetrachloride	5.99E-10	1.12E-11	0.0007	1.60E-08	1.28E-12	0.13	1.66E-13
Chloroethane	5.25E-09	9.82E-11	-	NA	1.12E-11	-	NA
Chloroform	2.50E-09	4.68E-11	0.01	4.68E-09	5.34E-12	0.08	4.28E-13
Methylene Chloride	8.37E-07	1.56E-08	0.86	1.82E-08	1.79E-09	0.0016	2.86E-12
Tetrachloroethene	8.35E-10	1.56E-11	0.01	1.56E-09	1.78E-12	0.018	3.21E-14
Toluene	7.00E-07	1.31E-08	0.57	2.30E-08	1.50E-09	-	NA
Trichloroethene	9.02E-07	1.69E-08	-	NA	1.93E-09	0.017	3.28E-11
Trichlorofluoromethane	6.02E-08	1.13E-09	0.2	5.63E-09	1.29E-10	-	NA
Xylenes (mixed)	2.91E-09	5.44E-11	0.086	6.32E-10	6.21E-12	-	NA
			Hazard Index:	**<0.001**	**Total Risk:**		**5 E-11**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-5
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE CURRENT TRESPASSER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	4.14E-10	7.74E-12	4	1.93E-12	8.84E-13	-	NA
bis(2-Ethylhexyl)phthalate	1.83E-10	3.41E-12	0.02	1.71E-10	3.90E-13	0.014	5.46E-15
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	2.77E-08	30	9.22E-10	3.16E-09	-	NA
tert-butylmethylether	1.27E-09	2.36E-11	-	NA	2.70E-12	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	7.71E-10	0.3	2.57E-09	8.81E-11	-	NA
Trichloroethane (total)	2.31E-08	4.32E-10	0.004	1.08E-07	4.93E-11	0.056	2.76E-12
1,1-Dichloroethane	2.54E-08	4.75E-10	0.1	4.75E-09	5.43E-11	-	NA
1,1-Dichloroethene	2.03E-08	3.80E-10	0.009	4.22E-08	4.34E-11	0.175	7.60E-12
1,2-Dichloroethane	5.19E-09	9.71E-11	-	NA	1.11E-11	0.091	1.01E-12
cis-1,2-Dichloroethene	6.59E-07	1.23E-08	0.01	1.23E-06	1.41E-09	-	NA
trans-1,2-Dichloroethene	2.97E-09	5.55E-11	0.02	2.78E-09	6.34E-12	-	NA
Benzene	2.96E-07	5.53E-09	-	NA	6.32E-10	0.029	1.83E-11
Carbon Tetrachloride	6.42E-10	1.20E-11	0.0007	1.71E-08	1.37E-12	0.13	1.78E-13
Chloroethane	5.25E-09	9.82E-11	-	NA	1.12E-11	-	NA
Chloroform	4.14E-09	7.74E-11	0.01	7.74E-09	8.85E-12	0.08	7.08E-13
Ethylbenzene	4.24E-07	7.92E-09	0.28	2.83E-08	9.05E-10	-	NA
Methylene Chloride	3.03E-07	5.67E-09	0.86	6.60E-09	6.48E-10	0.0016	1.04E-12
Tetrachloroethene	1.90E-07	3.55E-09	0.01	3.55E-07	4.05E-10	0.018	7.29E-12
Toluene	1.33E-06	2.49E-08	0.57	4.37E-08	2.85E-09	-	NA
Trichloroethene	1.13E-07	2.12E-09	-	NA	2.42E-10	0.017	4.12E-12
Trichlorofluoromethane	6.02E-08	1.13E-09	0.2	5.63E-09	1.29E-10	-	NA
Xylenes (mixed)	2.48E-06	4.64E-08	0.086	5.40E-07	5.31E-09	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**4 E-11**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-6
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
bis(2-Ethylhexyl)phthalate	1.47E-10	1.59E-11	0.02	7.94E-10	6.81E-12	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	1.60E-07	30	5.32E-09	6.85E-08	-	NA
tert-butylmethylether	1.27E-09	1.37E-10	-	NA	5.85E-11	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	4.45E-09	0.3	1.48E-08	1.91E-09	-	NA
1,1-Dichloroethane	2.54E-08	2.74E-09	0.1	2.74E-08	1.17E-09	-	NA
1,1-Dichloroethene	2.03E-08	2.19E-09	0.009	2.44E-07	9.40E-10	0.175	1.64E-10
1,2-Dichloroethane	5.19E-09	5.60E-10	-	NA	2.40E-10	0.091	2.19E-11
cis-1,2-Dichloroethene	6.59E-07	7.11E-08	0.01	7.11E-06	3.05E-08	-	NA
trans-1,2-Dichloroethene	2.97E-09	3.20E-10	0.02	1.60E-08	1.37E-10	-	NA
Benzene	3.23E-09	3.49E-10	-	NA	1.49E-10	0.029	4.33E-12
Chloroethane	5.25E-09	5.67E-10	-	NA	2.43E-10	-	NA
Methylene Chloride	1.95E-09	2.10E-10	0.86	2.44E-10	9.00E-11	0.0016	1.44E-13
Tetrachloroethene	2.76E-07	2.98E-08	0.01	2.98E-06	1.28E-08	0.018	2.30E-10
Trichloroethene	4.35E-06	4.69E-07	-	NA	2.01E-07	0.017	3.42E-09
Trichlorofluoromethane	6.02E-08	6.50E-09	0.2	3.25E-08	2.79E-09	-	NA
Xylenes (mixed)	2.91E-09	3.14E-10	0.086	3.65E-09	1.34E-10	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**4 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-7
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (INDOOR) IN THE
CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Indoor)							
SVOCs							
bis(2-Ethylhexyl)phthalate	4.48E-11	9.67E-12	0.02	4.83E-10	4.14E-12	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	4.50E-07	9.72E-08	30	3.24E-09	4.17E-08	-	NA
tert-butylmethylether	3.85E-10	8.31E-11	-	NA	3.56E-11	-	NA
VOCs							
1,1,1-Trichloroethane	1.25E-08	2.71E-09	0.3	9.03E-09	1.16E-09	-	NA
1,1-Dichloroethane	7.73E-09	1.67E-09	0.1	1.67E-08	7.15E-10	-	NA
1,1-Dichloroethene	6.18E-09	1.33E-09	0.009	1.48E-07	5.72E-10	0.175	1.00E-10
1,2-Dichloroethane	1.58E-09	3.41E-10	-	NA	1.46E-10	0.091	1.33E-11
cis-1,2-Dichloroethene	2.01E-07	4.33E-08	0.01	4.33E-06	1.86E-08	-	NA
trans-1,2-Dichloroethene	9.03E-10	1.95E-10	0.02	9.75E-09	8.36E-11	-	NA
Benzene	9.83E-10	2.12E-10	-	NA	9.10E-11	0.029	2.64E-12
Chloroethane	1.60E-09	3.45E-10	-	NA	1.48E-10	-	NA
Methylene Chloride	5.92E-10	1.28E-10	0.86	1.49E-10	5.48E-11	0.0016	8.76E-14
Tetrachloroethene	8.40E-08	1.81E-08	0.01	1.81E-06	7.77E-09	0.018	1.40E-10
Trichloroethene	1.32E-06	2.86E-07	-	NA	1.22E-07	0.017	2.08E-09
Trichlorofluoromethane	1.83E-08	3.96E-09	0.2	1.98E-08	1.70E-09	-	NA
Xylenes (mixed)	8.85E-10	1.91E-10	0.086	2.22E-09	8.18E-11	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**2 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-8
TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE
CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Groundwater Ingestion							
VOCs							
1,1,1-Trichloroethane	0.004	1.30E-04	0.09	1.44E-03	5.57E-05	-	NA
Methylene Chloride	0.002	6.50E-05	0.06	1.08E-03	2.79E-05	0.0075	2.09E-07
Toluene	0.006	1.95E-04	0.2	9.75E-04	8.36E-05	-	NA
Trichloroethene	0.001	3.25E-05	-	NA	1.39E-05	0.011	1.53E-07
			Hazard Index:	**0.004**		**Total Risk:**	**4 E-07**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-9
TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Dermal Contact							
METALS							
Chromium	80.7	1.70E-06	1	1.70E-06	6.06E-07	-	NA
Copper	211	4.44E-06	0.037	1.20E-04	1.59E-06	-	NA
Lead	151	3.18E-06	-	NA	1.13E-06	-	NA
Nickel	28.7	6.04E-07	0.02	3.02E-05	2.16E-07	-	NA
Zinc	772	1.62E-05	0.2	8.12E-05	5.80E-06	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.91E-07	0.04	4.79E-06	6.84E-08	-	NA
Acenaphthylene	0.33	9.02E-08	-	NA	3.22E-08	-	NA
Anthracene	0.32	8.75E-08	0.3	2.92E-07	3.13E-08	-	NA
Benzo(a)anthracene	1	2.73E-07	-	NA	9.77E-08	1.1	1.07E-07
Benzo(a)pyrene	1.2	3.28E-07	-	NA	1.17E-07	7.3	8.56E-07
Benzo(b)fluoranthene	2	5.47E-07	-	NA	1.95E-07	1.2	2.34E-07
Benzo(g,h,i)perylene	0.81	2.22E-07	0.04	5.54E-06	7.91E-08	0.11	8.70E-09
Benzo(k)fluoranthene	0.95	2.60E-07	-	NA	9.28E-08	0.15	1.39E-08
Chrysene	1	2.73E-07	-	NA	9.77E-08	0.032	3.13E-09
Dibenz(a,h)anthracene	0.23	6.29E-08	-	NA	2.25E-08	8.1	1.82E-07
Dibenzofuran	0.3	8.20E-08	0.04	2.05E-06	2.93E-08	-	NA
Fluoranthene	1.6	4.38E-07	0.04	1.09E-05	1.56E-07	-	NA
Fluorene	0.12	3.28E-08	0.04	8.20E-07	1.17E-08	-	NA
Indeno(1,2,3-cd)pyrene	1.1	3.01E-07	-	NA	1.07E-07	0.15	1.61E-08
Naphthalene	0.4	1.09E-07	0.04	2.73E-06	3.91E-08	-	NA
Phenanthrene	1.6	4.38E-07	0.04	1.09E-05	1.56E-07	-	NA
Pyrene	1.6	4.38E-07	0.03	1.46E-05	1.56E-07	-	NA
SVOCs							
Benzoic Acid	0.26	5.47E-08	4	1.37E-08	1.95E-08	-	NA
bis(2-ethylhexyl)phthalate	0.93	1.96E-07	0.02	9.78E-06	6.99E-08	0.014	9.78E-10
Butylbenzylphthalate	0.39	8.20E-08	0.2	4.10E-07	2.93E-08	-	NA
Di-n-butylphthalate	0.099	2.08E-08	0.1	2.08E-07	7.44E-09	-	NA
VOCs							
Acetone	0.14	7.36E-08	0.1	7.36E-07	2.63E-08	-	NA
Trichloroethene	0.005	2.63E-09	-	NA	9.39E-10	0.011	1.03E-11
			Hazard Index:	**<0.001**		**Total Risk:**	**1 E-06**

ADD = [redacted] Daily Dose
RfD = R[redacted]ce Dose
Hazard Quotient = ADD / RfD

LADD = Li[redacted] Average Daily Dose
SF = Carcin[redacted]ic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-10
TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE
FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Soil Ingestion							
METALS							
Chromium	80.7	1.97E-06	1	1.97E-06	7.05E-07	-	NA
Copper	211	5.16E-06	0.037	1.39E-04	1.84E-06	-	NA
Lead	151	3.69E-06	-	NA	1.32E-06	-	NA
Nickel	28.7	7.02E-07	0.02	3.51E-05	2.51E-07	-	NA
Zinc	772	1.89E-05	0.2	9.44E-05	6.74E-06	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.71E-08	0.04	4.28E-07	6.12E-09	-	NA
Acenaphthylene	0.33	8.07E-09	-	NA	2.88E-09	-	NA
Anthracene	0.32	7.83E-09	0.3	2.61E-08	2.80E-09	-	NA
Benzo(a)anthracene	1	2.45E-08	-	NA	8.74E-09	1.1	9.61E-09
Benzo(a)pyrene	1.2	2.94E-08	-	NA	1.05E-08	7.3	7.65E-08
Benzo(b)fluoranthene	2	4.89E-08	-	NA	1.75E-08	1.2	2.10E-08
Benzo(g,h,i)perylene	0.81	1.98E-08	0.04	4.95E-07	7.08E-09	0.11	7.78E-10
Benzo(k)fluoranthene	0.95	2.32E-08	-	NA	8.30E-09	0.15	1.24E-09
Chrysene	1	2.45E-08	-	NA	8.74E-09	0.032	2.80E-10
Dibenz(a,h)anthracene	0.23	5.63E-09	-	NA	2.01E-09	8.1	1.63E-08
Dibenzofuran	0.3	7.34E-09	0.04	1.83E-07	2.62E-09	-	NA
Fluoranthene	1.6	3.91E-08	0.04	9.78E-07	1.40E-08	-	NA
Fluorene	0.12	2.94E-09	0.04	7.34E-08	1.05E-09	-	NA
Indeno(1,2,3-cd)pyrene	1.1	2.69E-08	-	NA	9.61E-09	0.15	1.44E-09
Naphthalene	0.4	9.78E-09	0.04	2.45E-07	3.49E-09	-	NA
Phenanthrene	1.6	3.91E-08	0.04	9.78E-07	1.40E-08	-	NA
Pyrene	1.6	3.91E-08	0.03	1.30E-06	1.40E-08	-	NA
SVOCs							
Benzoic Acid	0.26	6.36E-09	4	1.59E-09	2.27E-09	-	NA
bis(2-ethylhexyl)phthalate	0.93	2.27E-08	0.02	1.14E-06	8.12E-09	0.014	1.14E-10
Butylbenzylphthalate	0.39	9.54E-09	0.2	4.77E-08	3.41E-09	-	NA
Di-n-butylphthalate	0.099	2.42E-09	0.1	2.42E-08	8.65E-10	-	NA
VOCs							
Acetone	0.14	3.42E-09	0.1	3.42E-08	1.22E-09	-	NA
Trichloroethene	0.005	1.22E-10	-	NA	4.37E-11	0.011	4.81E-13
			Hazard Index:	**<0.001**		**Total Risk:**	**1 E-07**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-11

TOTAL INTAKE AND RISKS FROM PARTICULATE INHALATION OF SOIL IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Particulate Inhalation							
METALS							
Chromium	80.7	2.66E-09	0.00000057	4.68E-03	9.52E-10	-	NA
Copper	211	6.97E-09	0.037	1.88E-07	2.49E-09	-	NA
Lead	151	4.99E-09	-	NA	1.78E-09	-	NA
Nickel	28.7	9.48E-10	0.02	4.74E-08	3.38E-10	0.84	2.84E-10
Zinc	772	2.55E-08	0.2	1.27E-07	9.11E-09	-	NA
PAHs							
2-Methylnaphthalene	0.7	2.31E-11	0.04	5.78E-10	8.26E-12	-	NA
Acenaphthylene	0.33	1.09E-11	-	NA	3.89E-12	-	NA
Anthracene	0.32	1.06E-11	0.3	3.52E-11	3.77E-12	-	NA
Benzo(a)anthracene	1	3.30E-11	-	NA	1.18E-11	0.88	1.04E-11
Benzo(a)pyrene	1.2	3.96E-11	-	NA	1.42E-11	6.1	8.63E-11
Benzo(b)fluoranthene	2	6.60E-11	-	NA	2.36E-11	1	2.36E-11
Benzo(g,h,i)perylene	0.81	2.67E-11	0.04	6.69E-10	9.55E-12	0.092	8.79E-13
Benzo(k)fluoranthene	0.95	3.14E-11	-	NA	1.12E-11	0.12	1.34E-12
Chrysene	1	3.30E-11	-	NA	1.18E-11	0.027	3.18E-13
Dibenz(a,h)anthracene	0.23	7.60E-12	-	NA	2.71E-12	6.8	1.84E-11
Dibenzofuran	0.3	9.91E-12	0.04	2.48E-10	3.54E-12	-	NA
Fluoranthene	1.6	5.28E-11	0.04	1.32E-09	1.89E-11	-	NA
Fluorene	0.12	3.96E-12	0.04	9.91E-11	1.42E-12	-	NA
Indeno(1,2,3-cd)pyrene	1.1	3.63E-11	-	NA	1.30E-11	0.13	1.69E-12
Naphthalene	0.4	1.32E-11	0.04	3.30E-10	4.72E-12	-	NA
Phenanthrene	1.6	5.28E-11	0.04	1.32E-09	1.89E-11	-	NA
Pyrene	1.6	5.28E-11	0.03	1.76E-09	1.89E-11	-	NA
SVOCs							
Benzoic Acid	0.26	8.59E-12	4	2.15E-12	3.07E-12	-	NA
bis(2-ethylhexyl)phthalate	0.93	3.07E-11	0.02	1.54E-09	1.10E-11	-	NA
Butylbenzylphthalate	0.39	1.29E-11	0.2	6.44E-11	4.60E-12	-	NA
Di-n-butylphthalate	0.099	3.27E-12	0.1	3.27E-11	1.17E-12	-	NA
VOCs							
Acetone	0.14	4.62E-12	0.1	4.62E-11	1.65E-12	-	NA
Trichloroethene	0.005	1.65E-13	-	NA	5.90E-14	0.017	1.00E-15
			Hazard Index:	**5 E-03**		**Total Risk:**	**4 E-10**

ADD = [redacted] Daily Dose
RfD = Re[redacted]ce Dose
Hazard Quotient = ADD / RfD

LADD = Lif[redacted]verage Daily Dose
SF = Carcino[redacted]ic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-12
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	3.15E-10	7.71E-12	4	1.93E-12	2.75E-12	-	NA
bis(2-ethylhexyl)phthalate	1.47E-10	3.60E-12	0.02	1.80E-10	1.29E-12	-	NA
Di-n-butylphthalate	1.42E-13	3.47E-15	0.1	3.47E-14	1.24E-15	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	3.62E-08	30	1.21E-09	1.29E-08	-	NA
tert-butylmethylether	1.27E-09	3.09E-11	-	NA	1.11E-11	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	1.01E-09	0.3	3.36E-09	3.60E-10	-	NA
Trichloroethane (total)	1.29E-08	3.15E-10	0.004	7.88E-08	1.13E-10	0.056	6.30E-12
1,1-Dichloroethane	2.54E-08	6.21E-10	0.1	6.21E-09	2.22E-10	-	NA
1,1-Dichloroethene	2.03E-08	4.97E-10	0.009	5.52E-08	1.77E-10	0.175	3.11E-11
1,2-Dichloroethane	5.19E-09	1.27E-10	-	NA	4.54E-11	0.091	4.13E-12
cis-1,2-Dichloroethene	6.59E-07	1.61E-08	0.01	1.61E-06	5.76E-09	-	NA
trans-1,2-Dichloroethene	2.97E-09	7.26E-11	0.02	3.63E-09	2.59E-11	-	NA
1,2-Dichloroethene (total)	5.40E-06	1.32E-07	0.02	6.60E-06	4.71E-08	-	NA
Acetone	1.30E-06	3.18E-08	0.1	3.18E-07	1.14E-08	-	NA
Benzene	3.23E-09	7.91E-11	-	NA	2.82E-11	0.029	8.19E-13
Carbon Tetrachloride	5.99E-10	1.47E-11	0.0007	2.09E-08	5.24E-12	0.13	6.81E-13
Chloroethane	5.25E-09	1.28E-10	-	NA	4.59E-11	-	NA
Chloroform	2.50E-09	6.12E-11	0.01	6.12E-09	2.19E-11	0.08	1.75E-12
Methylene Chloride	8.37E-07	2.05E-08	0.86	2.38E-08	7.31E-09	0.0016	1.17E-11
Tetrachloroethene	8.35E-10	2.04E-11	0.01	2.04E-09	7.30E-12	0.018	1.31E-13
Toluene	7.00E-07	1.71E-08	0.57	3.00E-08	6.11E-09	-	NA
Trichloroethene	9.02E-07	2.21E-08	-	NA	7.88E-09	0.017	1.34E-10
Trichlorofluoromethane	6.02E-09	1.47E-09	0.2	7.37E-09	5.26E-10	-	NA
Xylenes (mixed)	2.91E-09	7.11E-11	0.086	8.27E-10	2.54E-11	-	NA

Hazard Index: <0.001 **Total Risk:** 2 E-10

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-13
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (INDOOR) IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Indoor)							
SVOCs							
Benzoic Acid	0.00E+00	0.00E+00	4	0.00E+00	0.00E+00	-	NA
bis(2-ethylhexyl)phthalate	0.00E+00	0.00E+00	0.02	0.00E+00	0.00E+00	-	NA
Di-n-butylphthalate	0.00E+00	0.00E+00	0.1	0.00E+00	0.00E+00	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	0.00E+00	0.00E+00	30	0.00E+00	0.00E+00	-	NA
tert-butylmethylether	0.00E+00	0.00E+00	-	NA	0.00E+00	-	NA
VOCs							
1,1,1-Trichloroethane	0.00E+00	0.00E+00	0.3	0.00E+00	0.00E+00	-	NA
Trichloroethane (total)	9.11E-08	1.56E-08	0.004	3.90E-06	5.57E-09	0.056	3.12E-10
1,1-Dichloroethane	0.00E+00	0.00E+00	0.1	0.00E+00	0.00E+00	-	NA
1,1-Dichloroethene	0.00E+00	0.00E+00	0.009	0.00E+00	0.00E+00	0.175	0.00E+00
1,2-Dichloroethane	0.00E+00	0.00E+00	-	NA	0.00E+00	0.091	0.00E+00
cis-1,2-Dichloroethene	0.00E+00	0.00E+00	0.01	0.00E+00	0.00E+00	-	NA
trans-1,2-Dichloroethene	0.00E+00	0.00E+00	0.02	0.00E+00	0.00E+00	-	NA
1,2-Dichloroethene (total)	0.00E+00	0.00E+00	0.02	0.00E+00	0.00E+00	-	NA
Acetone	3.96E-07	6.77E-08	0.1	6.77E-07	2.42E-08	-	NA
Benzene	0.00E+00	0.00E+00	-	NA	0.00E+00	0.029	0.00E+00
Carbon Tetrachloride	4.56E-10	7.81E-11	0.0007	1.12E-07	2.79E-11	0.13	3.63E-12
Chloroethane	0.00E+00	0.00E+00	-	NA	0.00E+00	-	NA
Chloroform	2.54E-08	4.34E-09	0.01	4.34E-07	1.55E-09	0.08	1.24E-10
Methylene Chloride	2.54E-07	4.35E-08	0.86	5.06E-08	1.55E-08	0.0016	2.49E-11
Tetrachloroethene	2.97E-09	5.08E-10	0.01	5.08E-08	1.81E-10	0.018	3.26E-12
Toluene	8.96E-07	1.53E-07	0.57	2.69E-07	5.48E-08	-	NA
Trichloroethene	2.79E-06	4.77E-07	-	NA	1.70E-07	0.017	2.90E-09
Trichlorofluoromethane	0.00E+00	0.00E+00	0.2	0.00E+00	0.00E+00	-	NA
Xylenes (mixed)	0.00E+00	0.00E+00	0.086	0.00E+00	0.00E+00	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**3 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD
LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF
NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
A concentration of zero indicates that the chemical was not chosen for evaluation via this pathway

Table 6-14
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE FUTURE ONSITE WORKER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	4.14E-10	1.01E-11	4	2.53E-12	3.62E-12	-	NA
bis(2-Ethylhexyl)phthalate	1.83E-10	4.47E-12	0.02	2.23E-10	1.60E-12	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	3.62E-08	30	1.21E-09	1.29E-08	-	NA
tert-butylmethylether	1.27E-09	3.09E-11	-	NA	1.11E-11	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	1.01E-09	0.3	3.36E-09	3.60E-10	-	NA
Trichloroethane (total)	2.31E-08	5.65E-10	0.004	1.41E-07	2.02E-10	0.056	1.13E-11
1,1-Dichloroethane	2.54E-08	6.21E-10	0.1	6.21E-09	2.22E-10	-	NA
1,1-Dichloroethene	2.03E-08	4.97E-10	0.009	5.52E-08	1.77E-10	0.175	3.11E-11
1,2-Dichloroethane	5.19E-09	1.27E-10	-	NA	4.54E-11	0.091	4.13E-12
cis-1,2-Dichloroethene	6.59E-07	1.61E-08	0.01	1.61E-06	5.76E-09	-	NA
trans-1,2-Dichloroethene	2.97E-09	7.26E-11	0.02	3.63E-09	2.59E-11	-	NA
Benzene	2.96E-07	7.24E-09	-	NA	2.58E-09	0.029	7.49E-11
Carbon Tetrachloride	6.42E-10	1.57E-11	0.0007	2.24E-08	5.61E-12	0.13	7.29E-13
Chloroethane	5.25E-09	1.28E-10	-	NA	4.59E-11	-	NA
Chloroform	4.14E-09	1.01E-10	0.01	1.01E-08	3.62E-11	0.08	2.89E-12
Ethylbenzene	4.24E-07	1.04E-08	0.28	3.70E-08	3.70E-09	-	NA
Methylene Chloride	3.03E-07	7.42E-09	0.86	8.63E-09	2.65E-09	0.0016	4.24E-12
Tetrachloroethene	1.90E-07	4.64E-09	0.01	4.64E-07	1.66E-09	0.018	2.98E-11
Toluene	1.33E-06	3.26E-08	0.57	5.72E-08	1.16E-08	-	NA
Trichloroethene	1.13E-07	2.78E-09	-	NA	9.91E-10	0.017	1.69E-11
Trichlorofluoromethane	6.02E-08	1.47E-09	0.2	7.37E-09	5.26E-10	-	NA
Xylenes (mixed)	2.48E-06	6.08E-08	0.086	7.06E-07	2.17E-08	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**2 E-10**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-15
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (INDOOR) IN THE FUTURE ONSITE WORKER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Indoor)							
SVOCs							
Benzoic Acid	1.26E-10	2.16E-11	4	5.39E-12	7.70E-12	-	NA
bis(2-Ethylhexyl)phthalate	4.46E-12	7.65E-13	0.02	3.82E-11	2.73E-13	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	0.00E+00	0.00E+00	30	0.00E+00	0.00E+00	-	NA
tert-butylmethylether	0.00E+00	0.00E+00	-	NA	0.00E+00	-	NA
VOCs							
1,1,1-Trichloroethane	3.04E-09	5.20E-10	0.3	1.73E-09	1.86E-10	-	NA
Trichloroethane (total)	7.81E-08	1.34E-08	0.004	3.34E-06	4.77E-09	0.056	2.67E-10
1,1-Dichloroethane	0.00E+00	0.00E+00	0.1	0.00E+00	0.00E+00	-	NA
1,1-Dichloroethene	0.00E+00	0.00E+00	0.009	0.00E+00	0.00E+00	0.175	0.00E+00
1,2-Dichloroethane	0.00E+00	0.00E+00	-	NA	0.00E+00	0.091	0.00E+00
cis-1,2-Dichloroethene	1.21E-09	2.07E-10	0.01	2.07E-08	7.41E-11	-	NA
trans-1,2-Dichloroethene	0.00E+00	0.00E+00	0.02	0.00E+00	0.00E+00	-	NA
Benzene	8.54E-07	1.46E-07	-	NA	5.22E-08	0.029	1.51E-09
Carbon Tetrachloride	7.81E-10	1.34E-10	0.0007	1.91E-07	4.78E-11	0.13	6.21E-12
Chloroethane	0.00E+00	0.00E+00	-	NA	0.00E+00	-	NA
Chloroform	1.26E-08	2.16E-09	0.01	2.16E-07	7.71E-10	0.08	6.17E-11
Ethylbenzene	2.29E-07	3.92E-08	0.28	1.40E-07	1.40E-08	-	NA
Methylene Chloride	5.20E-10	8.90E-11	0.86	1.04E-10	3.18E-11	0.0016	5.09E-14
Tetrachloroethene	1.09E-06	1.86E-07	0.01	1.86E-05	6.66E-08	0.018	1.20E-09
Toluene	3.84E-06	6.57E-07	0.57	1.15E-06	2.35E-07	-	NA
Trichloroethene	1.19E-07	2.04E-08	-	NA	7.30E-09	0.017	1.24E-10
Trichlorofluoromethane	0.00E+00	0.00E+00	0.2	0.00E+00	0.00E+00	-	NA
Xylenes (mixed)	2.81E-06	4.81E-07	0.086	5.59E-06	1.72E-07	-	NA

Hazard Index: <0.001 **Total Risk: 3 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD
LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF
NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
A concentration of zero indicates that the chemical was not chosen for evaluation via this pathway

Table 6-16
TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Groundwater Ingestion							
METALS							
Aluminum	1.0121	1.98E-02	-	NA	7.07E-03	-	NA
Arsenic	0.0017	3.33E-05	0.0003	1.11E-01	1.19E-05	1.75	2.08E-05
Barium	0.3041	5.95E-03	0.07	8.50E-02	2.13E-03	-	NA
Beryllium	0.0008	1.47E-05	0.005	2.95E-03	5.27E-06	4.3	2.26E-05
Chromium	0.0055	1.08E-04	1	1.08E-04	3.86E-05	-	NA
Cobalt	0.0075	1.47E-04	-	NA	5.24E-05	-	NA
Copper	0.0103	2.01E-04	0.037	5.43E-03	7.17E-05	-	NA
Manganese	0.8203	1.61E-02	0.1	1.61E-01	5.73E-03	-	NA
Nickel	0.0141	2.76E-04	0.02	1.38E-02	9.87E-05	-	NA
Vanadium	0.0042	8.16E-05	0.007	1.17E-02	2.92E-05	-	NA
SVOCs							
Dimethylphthalate	0.0053	1.04E-04	1	1.04E-04	3.73E-05	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0030	5.87E-05	30	1.96E-06	2.10E-05	-	NA
Carbon Disulfide	0.5600	1.10E-02	0.1	1.10E-01	3.91E-03	-	NA
tert-butylmethylether	0.0015	2.94E-05	-	NA	1.05E-05	-	NA
VOCs							
1,1,1-Trichloroethane	0.0015	3.01E-05	0.09	3.35E-04	1.08E-05	-	NA
1,1,2-Trichloroethane	0.0003	4.98E-06	0.004	1.25E-03	1.78E-06	0.057	1.01E-07
1,1-Dichloroethane	0.0016	3.22E-05	0.1	3.22E-04	1.15E-05	-	NA
1,1-Dichloroethene	0.0017	3.34E-05	0.009	3.71E-03	1.19E-05	0.6	7.16E-06
1,2,3-Trichlorobenzene	0.0003	4.93E-06	0.01	4.93E-04	1.76E-06	-	NA
1,2,4-Trimethylbenzene	0.0003	5.00E-06	-	NA	1.79E-06	-	NA
1,2-Dichloroethane	0.0009	1.76E-05	-	NA	6.30E-06	0.091	5.73E-07
cis-1,2-Dichloroethene	0.4138	8.10E-03	0.01	8.10E-01	2.89E-03	-	NA
trans-1,2-Dichloroethene	0.0019	3.65E-05	0.02	1.83E-03	1.30E-05	-	NA
1,3-Dichlorobenzene	0.0003	4.95E-06	0.09	5.50E-05	1.77E-06	-	NA
Benzene	0.0002	4.86E-06	-	NA	1.74E-06	0.029	5.03E-08
Carbon Tetrachloride	0.0003	6.10E-06	0.0007	8.71E-03	2.18E-06	0.13	2.83E-07

Table 6-16

TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Groundwater Ingestion							
Chlorobenzene	0.0003	4.94E-06	0.02	2.47E-04	1.76E-06	-	NA
Chloroethane	0.0003	6.39E-06	-	NA	2.28E-06	-	NA
Chloroform	0.0003	6.43E-06	0.01	6.43E-04	2.30E-06	0.0061	1.40E-08
Chloromethane	0.0003	6.66E-06	-	NA	2.38E-06	0.013	3.09E-08
Dichlorodifluoromethane	0.0004	7.53E-06	0.2	3.76E-05	2.69E-06	-	NA
Methylene Chloride	0.0002	3.84E-06	0.06	6.39E-05	1.37E-06	0.0075	1.03E-08
Tetrachloroethene	0.0032	6.27E-05	0.01	6.27E-03	2.24E-05	0.051	1.14E-06
Trichloroethene	1.0619	2.08E-02	-	NA	7.42E-03	0.011	8.16E-05
Trichlorofluoromethane	0.0003	6.02E-06	0.3	2.01E-05	2.15E-06	-	NA
Vinyl Chloride	0.0008	1.58E-05	-	NA	5.64E-06	1.9	1.07E-05
m,p-Xylene	0.0003	4.99E-06	2	2.50E-06	1.78E-06	-	NA
			Hazard Index:	**1.334**		**Total Risk:**	**1 E-04**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-17
TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Dermal Contact							
METALS							
Chromium	80.7	2.91E-06	1	2.91E-06	1.25E-06	-	NA
Copper	211	7.62E-06	0.037	2.06E-04	3.27E-06	-	NA
Lead	151	5.45E-06	-	NA	2.34E-06	-	NA
Nickel	28.7	1.04E-06	0.02	5.18E-05	4.44E-07	-	NA
Zinc	772	2.79E-05	0.2	1.39E-04	1.19E-05	-	NA
PAHs							
2-Methylnaphthalene	0.7	3.29E-07	0.04	8.22E-06	1.41E-07	-	NA
Acenaphthylene	0.33	1.55E-07	-	NA	6.64E-08	-	NA
Anthracene	0.32	1.50E-07	0.3	5.01E-07	6.44E-08	-	NA
Benzo(a)anthracene	1	4.69E-07	-	NA	2.01E-07	1.1	2.21E-07
Benzo(a)pyrene	1.2	5.63E-07	-	NA	2.41E-07	7.3	1.76E-06
Benzo(b)fluoranthene	2	9.39E-07	-	NA	4.02E-07	1.2	4.83E-07
Benzo(g,h,i)perylene	0.81	3.80E-07	0.04	9.51E-06	1.63E-07	0.11	1.79E-08
Benzo(k)fluoranthene	0.95	4.46E-07	-	NA	1.91E-07	0.15	2.87E-08
Chrysene	1	4.69E-07	-	NA	2.01E-07	0.032	6.44E-09
Dibenz(a,h)anthracene	0.23	1.08E-07	-	NA	4.63E-08	8.1	3.75E-07
Dibenzofuran	0.3	1.41E-07	0.04	3.52E-06	6.04E-08	-	NA
Fluoranthene	1.6	7.51E-07	0.04	1.88E-05	3.22E-07	-	NA
Fluorene	0.12	5.63E-08	0.04	1.41E-06	2.41E-08	-	NA
Indeno(1,2,3-cd)pyrene	1.1	5.16E-07	-	NA	2.21E-07	0.15	3.32E-08
Naphthalene	0.4	1.88E-07	0.04	4.69E-06	8.05E-08	-	NA
Phenanthrene	1.6	7.51E-07	0.04	1.88E-05	3.22E-07	-	NA
Pyrene	1.6	7.51E-07	0.03	2.50E-05	3.22E-07	-	NA
SVOCs							
Benzoic Acid	0.26	9.39E-08	4	2.35E-08	4.02E-08	-	NA
bis(2-ethylhexyl)phthalate	0.93	3.36E-07	0.02	1.68E-05	1.44E-07	0.014	2.02E-09
Butylbenzylphthalate	0.39	1.41E-07	0.2	7.04E-07	6.04E-08	-	NA
Di-n-butylphthalate	0.099	3.58E-08	0.1	3.58E-07	1.53E-08	-	NA
VOCs							
Acetone	0.14	1.26E-07	0.1	1.26E-06	5.42E-08	-	NA
Trichloroethene	0.005	4.51E-09	-	NA	1.93E-09	0.011	2.13E-11
			Hazard Index:	**<0.001**		**Total Risk:**	**3 E-06**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-18
TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE
FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Soil Ingestion							
METALS							
Chromium	80.7	7.87E-06	1	7.87E-06	3.37E-06	-	NA
Copper	211	2.06E-05	0.037	5.56E-04	8.82E-06	-	NA
Lead	151	1.47E-05	-	NA	6.31E-06	-	NA
Nickel	28.7	2.80E-06	0.02	1.40E-04	1.20E-06	-	NA
Zinc	772	7.53E-05	0.2	3.76E-04	3.23E-05	-	NA
PAHs							
2-Methylnaphthalene	0.7	6.83E-08	0.04	1.71E-06	2.93E-08	-	NA
Acenaphthylene	0.33	3.22E-08	-	NA	1.38E-08	-	NA
Anthracene	0.32	3.12E-08	0.3	1.04E-07	1.34E-08	-	NA
Benzo(a)anthracene	1	9.75E-08	-	NA	4.18E-08	1.1	4.60E-08
Benzo(a)pyrene	1.2	1.17E-07	-	NA	5.02E-08	7.3	3.66E-07
Benzo(b)fluoranthene	2	1.95E-07	-	NA	8.36E-08	1.2	1.00E-07
Benzo(g,h,i)perylene	0.81	7.90E-08	0.04	1.97E-06	3.39E-08	0.11	3.72E-09
Benzo(k)fluoranthene	0.95	9.26E-08	-	NA	3.97E-08	0.15	5.96E-09
Chrysene	1	9.75E-08	-	NA	4.18E-08	0.032	1.34E-09
Dibenz(a,h)anthracene	0.23	2.24E-08	-	NA	9.61E-09	8.1	7.79E-08
Dibenzofuran	0.3	2.93E-08	0.04	7.31E-07	1.25E-08	-	NA
Fluoranthene	1.6	1.56E-07	0.04	3.90E-06	6.69E-08	-	NA
Fluorene	0.12	1.17E-08	0.04	2.93E-07	5.02E-09	-	NA
Indeno(1,2,3-cd)pyrene	1.1	1.07E-07	-	NA	4.60E-08	0.15	6.90E-09
Naphthalene	0.4	3.90E-08	0.04	9.75E-07	1.67E-08	-	NA
Phenanthrene	1.6	1.56E-07	0.04	3.90E-06	6.69E-08	-	NA
Pyrene	1.6	1.56E-07	0.03	5.20E-06	6.69E-08	-	NA
SVOCs							
Benzoic Acid	0.26	2.54E-08	4	6.34E-09	1.09E-08	-	NA
bis(2-ethylhexyl)phthalate	0.93	9.07E-08	0.02	4.53E-06	3.89E-08	0.014	5.44E-10
Butylbenzylphthalate	0.39	3.80E-08	0.2	1.90E-07	1.63E-08	-	NA
Di-n-butylphthalate	0.099	9.65E-09	0.1	9.65E-08	4.14E-09	-	NA
VOCs							
Acetone	0.14	1.37E-08	0.1	1.37E-07	5.85E-09	-	NA
Trichloroethene	0.005	4.88E-10	-	NA	2.09E-10	0.011	2.30E-12
			Hazard Index:	**1 E-03**		**Total Risk:**	**6 E-07**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-19
TOTAL INTAKE AND RISKS FROM PARTICULATE INHALATION OF SOIL IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/kg)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) -1	CARCINOGENIC RISK
Particulate Inhalation							
METALS							
Chromium	80.7	1.18E-08	0.00000057	2.06E-02	5.04E-09	-	NA
Copper	211	3.07E-08	0.037	8.31E-07	1.32E-08	-	NA
Lead	151	2.20E-08	-	NA	9.43E-09	-	NA
Nickel	28.7	4.18E-09	0.02	2.09E-07	1.79E-09	0.84	1.51E-09
Zinc	772	1.12E-07	0.2	5.62E-07	4.82E-08	-	NA
PAHs							
2-Methylnaphthalene	0.7	1.02E-10	0.04	2.55E-09	4.37E-11	-	NA
Acenaphthylene	0.33	4.81E-11	-	NA	2.06E-11	-	NA
Anthracene	0.32	4.66E-11	0.3	1.55E-10	2.00E-11	-	NA
Benzo(a)anthracene	1	1.46E-10	-	NA	6.24E-11	0.88	5.49E-11
Benzo(a)pyrene	1.2	1.75E-10	-	NA	7.49E-11	6.1	4.57E-10
Benzo(b)fluoranthene	2	2.91E-10	-	NA	1.25E-10	1	1.25E-10
Benzo(g,h,i)perylene	0.81	1.18E-10	0.04	2.95E-09	5.06E-11	0.092	4.65E-12
Benzo(k)fluoranthene	0.95	1.38E-10	-	NA	5.93E-11	0.12	7.12E-12
Chrysene	1	1.46E-10	-	NA	6.24E-11	0.027	1.69E-12
Dibenz(a,h)anthracene	0.23	3.35E-11	-	NA	1.44E-11	6.8	9.77E-11
Dibenzofuran	0.3	4.37E-11	0.04	1.09E-09	1.87E-11	-	NA
Fluoranthene	1.6	2.33E-10	0.04	5.83E-09	9.99E-11	-	NA
Fluorene	0.12	1.75E-11	0.04	4.37E-10	7.49E-12	-	NA
Indeno(1,2,3-cd)pyrene	1.1	1.60E-10	-	NA	6.87E-11	0.13	8.93E-12
Naphthalene	0.4	5.83E-11	0.04	1.46E-09	2.50E-11	-	NA
Phenanthrene	1.6	2.33E-10	0.04	5.83E-09	9.99E-11	-	NA
Pyrene	1.6	2.33E-10	0.03	7.77E-09	9.99E-11	-	NA
SVOCs							
Benzoic Acid	0.26	3.79E-11	4	9.47E-12	1.62E-11	-	NA
bis(2-ethylhexyl)phthalate	0.93	1.35E-10	0.02	6.77E-09	5.81E-11	-	NA
Butylbenzylphthalate	0.39	5.68E-11	0.2	2.84E-10	2.44E-11	-	NA
Di-n-butylphthalate	0.099	1.44E-11	0.1	1.44E-10	6.18E-12	-	NA
VOCs							
Acetone	0.14	2.04E-11	0.1	2.04E-10	8.74E-12	-	NA
Trichloroethene	0.005	7.28E-13	-	NA	3.12E-13	0.017	5.31E-15
			Hazard Index:	**2 E-02**		**Total Risk:**	**2 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

1E-6 = 1/1,000,000
NA = Not Applicable, no criteria.

Table 6-20
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	3.15E-10	3.40E-11	4	8.51E-12	1.46E-11	-	NA
bis(2-ethylhexyl)phthalate	1.47E-10	1.59E-11	0.02	7.94E-10	6.81E-12	-	NA
Di-n-butylphthalate	1.42E-13	1.53E-14	0.1	1.53E-13	6.55E-15	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	1.60E-07	30	5.32E-09	6.85E-08	-	NA
tert-butylmethylether	1.27E-09	1.37E-10	-	NA	5.85E-11	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	4.45E-09	0.3	1.48E-08	1.91E-09	-	NA
Trichloroethane (total)	4.86E-07	5.25E-08	0.004	1.31E-05	2.25E-08	0.056	1.26E-09
1,1-Dichloroethane	2.54E-08	2.74E-09	0.1	2.74E-08	1.17E-09	-	NA
1,1-Dichloroethene	2.03E-08	2.19E-09	0.009	2.44E-07	9.40E-10	0.175	1.64E-10
1,2-Dichloroethane	5.19E-09	5.60E-10	-	NA	2.40E-10	0.091	2.19E-11
cis-1,2-Dichloroethene	6.59E-07	7.11E-08	0.01	7.11E-06	3.05E-08	-	NA
trans-1,2-Dichloroethene	2.97E-09	3.20E-10	0.02	1.60E-08	1.37E-10	-	NA
1,2-Dichloroethene (total)	5.40E-06	5.82E-07	0.02	2.91E-05	2.50E-07	-	NA
Acetone	1.30E-06	1.40E-07	0.1	1.40E-06	6.01E-08	-	NA
Benzene	3.23E-09	3.49E-10	-	NA	1.49E-10	0.029	4.33E-12
Carbon Tetrachloride	3.07E-07	3.32E-08	0.0007	4.74E-05	1.42E-08	0.13	1.85E-09
Chloroethane	5.25E-09	5.67E-10	-	NA	2.43E-10	-	NA
Chloroform	1.28E-08	1.39E-09	0.01	1.39E-07	5.94E-10	0.08	4.75E-11
Methylene Chloride	8.37E-07	9.03E-08	0.86	1.05E-07	3.87E-08	0.0016	6.19E-11
Tetrachloroethene	1.28E-08	1.38E-09	0.01	1.38E-07	5.92E-10	0.018	1.07E-11
Toluene	2.75E-06	2.97E-07	0.57	5.20E-07	1.27E-07	-	NA
Trichloroethene	6.90E-07	7.44E-08	-	NA	3.19E-08	0.017	5.42E-10
Trichlorofluoromethane	6.02E-08	6.50E-09	0.2	3.25E-08	2.79E-09	-	NA
Xylenes (mixed)	2.91E-09	3.14E-10	0.086	3.65E-09	1.34E-10	-	NA

Hazard Index: <0.001 **Total Risk: 4 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-21
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (INDOOR) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Indoor)							
SVOCs							
Benzoic Acid	9.59E-11	2.07E-11	4	5.18E-12	8.87E-12	-	NA
bis(2-ethylhexyl)phthalate	4.48E-11	9.67E-12	0.02	4.83E-10	4.14E-12	-	NA
Di-n-butylphthalate	4.31E-14	9.31E-15	0.1	9.31E-14	3.99E-15	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	4.50E-07	9.72E-08	30	3.24E-09	4.17E-08	-	NA
tert-butylmethylether	3.85E-10	8.31E-11	-	NA	3.56E-11	-	NA
VOCs							
1,1,1-Trichloroethane	1.25E-08	2.71E-09	0.3	9.03E-09	1.16E-09	-	NA
Trichloroethane (total)	1.48E-07	3.19E-08	0.004	7.98E-06	1.37E-08	0.056	7.66E-10
1,1-Dichloroethane	7.73E-09	1.67E-09	0.1	1.67E-08	7.15E-10	-	NA
1,1-Dichloroethene	6.18E-09	1.33E-09	0.009	1.48E-07	5.72E-10	0.175	1.00E-10
1,2-Dichloroethane	1.58E-09	3.41E-10	-	NA	1.46E-10	0.091	1.33E-11
cis-1,2-Dichloroethene	2.01E-07	4.33E-08	0.01	4.33E-06	1.86E-08	-	NA
trans-1,2-Dichloroethene	9.03E-10	1.95E-10	0.02	9.75E-09	8.36E-11	-	NA
1,2-Dichloroethene (total)	1.64E-06	3.54E-07	0.02	1.77E-05	1.52E-07	-	NA
Acetone	3.96E-07	8.54E-08	0.1	8.54E-07	3.66E-08	-	NA
Benzene	9.83E-10	2.12E-10	-	NA	9.10E-11	0.029	2.64E-12
Carbon Tetrachloride	9.35E-08	2.02E-08	0.0007	2.88E-05	8.65E-09	0.13	1.12E-09
Chloroethane	1.60E-09	3.45E-10	-	NA	1.48E-10	-	NA
Chloroform	3.91E-09	8.43E-10	0.01	8.43E-08	3.61E-10	0.08	2.89E-11
Methylene Chloride	2.55E-07	5.50E-08	0.86	6.39E-08	2.36E-08	0.0016	3.77E-11
Tetrachloroethene	3.90E-09	8.41E-10	0.01	8.41E-08	3.61E-10	0.018	6.49E-12
Toluene	8.36E-07	1.80E-07	0.57	3.17E-07	7.73E-08	-	NA
Trichloroethene	2.10E-07	4.53E-08	-	NA	1.94E-08	0.017	3.30E-10
Trichlorofluoromethane	1.83E-08	3.96E-09	0.2	1.98E-08	1.70E-09	-	NA
Xylenes (mixed)	8.85E-10	1.91E-10	0.086	2.22E-09	8.18E-11	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**2 E-09**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-22
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (OUTDOOR) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Outdoor)							
SVOCs							
Benzoic Acid	4.14E-10	4.47E-11	4	1.12E-11	1.91E-11	-	NA
bis(2-Ethylhexyl)phthalate	1.83E-10	1.97E-11	0.02	9.85E-10	8.45E-12	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	1.48E-06	1.60E-07	30	5.32E-09	6.85E-08	-	NA
tert-butylmethylether	1.27E-09	1.37E-10	-	NA	5.85E-11	-	NA
VOCs							
1,1,1-Trichloroethane	4.12E-08	4.45E-09	0.3	1.48E-08	1.91E-09	-	NA
Trichloroethane (total)	2.31E-08	2.49E-09	0.004	6.23E-07	1.07E-09	0.056	5.98E-11
1,1-Dichloroethane	2.54E-08	2.74E-09	0.1	2.74E-08	1.17E-09	-	NA
1,1-Dichloroethene	2.03E-08	2.19E-09	0.009	2.44E-07	9.40E-10	0.175	1.64E-10
1,2-Dichloroethane	5.19E-09	5.60E-10	-	NA	2.40E-10	0.091	2.19E-11
cis-1,2-Dichloroethene	6.59E-07	7.11E-08	0.01	7.11E-06	3.05E-08	-	NA
trans-1,2-Dichloroethene	2.97E-09	3.20E-10	0.02	1.60E-08	1.37E-10	-	NA
Benzene	2.96E-07	3.19E-08	-	NA	1.37E-08	0.029	3.97E-10
Carbon tetrachloride	6.42E-10	6.93E-11	0.0007	9.90E-08	2.97E-11	0.13	3.86E-12
Chloroethane	5.25E-09	5.67E-10	-	NA	2.43E-10	-	NA
Chloroform	4.14E-09	4.47E-10	0.01	4.47E-08	1.92E-10	0.08	1.53E-11
Ethylbenzene	4.24E-07	4.57E-08	0.28	1.63E-07	1.96E-08	-	NA
Methylene Chloride	3.03E-07	3.27E-08	0.86	3.81E-08	1.40E-08	0.0016	2.25E-11
Tetrachloroethene	1.90E-07	2.05E-08	0.01	2.05E-06	8.77E-09	0.018	1.58E-10
Toluene	1.33E-06	1.44E-07	0.57	2.52E-07	6.16E-08	-	NA
Trichloroethene	1.13E-07	1.22E-08	-	NA	5.25E-09	0.017	8.92E-11
Trichlorofluoromethane	6.02E-08	6.50E-09	0.2	3.25E-08	2.79E-09	-	NA
Xylenes (mixed)	2.48E-06	2.68E-07	0.086	3.12E-06	1.15E-07	-	NA
				Hazard Index: <0.001		Total Risk:	9 E-10

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-23
TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (INDOOR) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	CONCENTRATION (mg/m^3)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (Indoor)							
SVOCs							
Benzoic Acid	1.26E-10	2.72E-11	4	6.80E-12	1.16E-11	-	NA
bis(2-Ethylhexyl)phthalate	5.56E-11	1.20E-11	0.02	6.00E-10	5.14E-12	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	4.50E-07	9.72E-08	30	3.24E-09	4.17E-08	-	NA
tert-butylmethylether	3.85E-10	8.31E-11	-	NA	3.56E-11	-	NA
VOCs							
1,1,1-Trichloroethane	1.25E-08	2.71E-09	0.3	9.03E-09	1.16E-09	-	NA
Trichloroethane (total)	7.03E-09	1.52E-09	0.004	3.79E-07	6.50E-10	0.056	3.64E-11
1,1-Dichloroethane	7.73E-09	1.67E-09	0.1	1.67E-08	7.15E-10	-	NA
1,1-Dichloroethene	6.18E-09	1.33E-09	0.009	1.48E-07	5.72E-10	0.175	1.00E-10
1,2-Dichloroethane	1.58E-09	3.41E-10	-	NA	1.46E-10	0.091	1.33E-11
cis-1,2-Dichloroethene	2.01E-07	4.33E-08	0.01	4.33E-06	1.86E-08	-	NA
trans-1,2-Dichloroethene	9.03E-10	1.95E-10	0.02	9.75E-09	8.36E-11	-	NA
Benzene	9.00E-08	1.94E-08	-	NA	8.33E-09	0.029	2.41E-10
Carbon tetrachloride	1.95E-10	4.22E-11	0.0007	6.02E-08	1.81E-11	0.13	2.35E-12
Chloroethane	1.60E-09	3.45E-10	-	NA	1.48E-10	-	NA
Chloroform	1.26E-09	2.72E-10	0.01	2.72E-08	1.17E-10	0.08	9.33E-12
Ethylbenzene	1.29E-07	2.78E-08	0.28	9.94E-08	1.19E-08	-	NA
Methylene Chloride	9.23E-08	1.99E-08	0.86	2.32E-08	8.54E-09	0.0016	1.37E-11
Tetrachloroethene	5.77E-08	1.25E-08	0.01	1.25E-06	5.34E-09	0.018	9.61E-11
Toluene	4.05E-07	8.75E-08	0.57	1.53E-07	3.75E-08	-	NA
Trichloroethene	3.45E-08	7.45E-09	-	NA	3.19E-09	0.017	5.43E-11
Trichlorofluoromethane	1.83E-08	3.96E-09	0.2	1.98E-08	1.70E-09	-	NA
Xylenes (mixed)	7.56E-07	1.63E-07	0.086	1.90E-06	6.99E-08	-	NA
			Hazard Index:	**<0.001**		**Total Risk:**	**6 E-10**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard Quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-24

TOTAL INTAKE AND RISKS FROM DERMAL CONTACT (DURING SHOWERING OR BATHING) WITH GROUNDWATER IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Dermal Contact							
METALS							
Aluminum	1.0121	6.99E-05	-	NA	3.00E-05	-	NA
Arsenic	0.0017	1.18E-07	0.0003	3.92E-04	5.04E-08	1.75	8.83E-08
Barium	0.3041	2.10E-05	0.07	3.00E-04	9.00E-06	-	NA
Beryllium	0.0008	5.20E-08	0.005	1.04E-05	2.23E-08	4.3	9.59E-08
Chromium	0.0055	3.82E-07	1	3.82E-07	1.64E-07	-	NA
Cobalt	0.0075	5.18E-07	-	NA	2.22E-07	-	NA
Copper	0.0103	7.09E-07	0.037	1.92E-05	3.04E-07	-	NA
Manganese	0.8203	5.67E-05	0.1	5.67E-04	2.43E-05	-	NA
Nickel	0.0141	9.76E-07	0.02	4.88E-05	4.18E-07	-	NA
Vanadium	0.0042	2.88E-07	0.007	4.12E-05	1.23E-07	-	NA
SVOCs							
Dimethylphthalate	0.0053	5.90E-07	1	5.90E-07	2.53E-07	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0030	5.00E-06	30	1.67E-07	2.14E-06	-	NA
Carbon Disulfide	0.5600	9.28E-04	0.1	9.28E-03	3.98E-04	-	NA
tert-butylmethylether	0.0015	1.50E-07	-	NA	6.45E-08	-	NA
VOCs							
1,1,1-Trichloroethane	0.0015	1.81E-06	0.09	2.01E-05	7.75E-07	-	NA
1,1,2-Trichloroethane	0.0003	1.48E-07	0.004	3.69E-05	6.33E-08	0.057	3.61E-09
1,1-Dichloroethane	0.0016	1.01E-06	0.1	1.01E-05	4.34E-07	-	NA
1,1-Dichloroethene	0.0017	1.89E-06	0.009	2.10E-04	8.08E-07	0.6	4.85E-07
1,2,3-Trichlorobenzene	0.0003	2.93E-06	0.01	2.93E-04	1.25E-06	-	NA
1,2,4-Trimethylbenzene	0.0003	8.43E-06	-	NA	3.61E-06	-	NA
1,2-Dichloroethane	0.0009	3.30E-07	-	NA	1.41E-07	0.091	1.29E-08
cis-1,2-Dichloroethene	0.4138	2.86E-04	0.01	2.86E-02	1.22E-04	-	NA
trans-1,2-Dichloroethene	0.0019	1.29E-06	0.02	6.44E-05	5.52E-07	-	NA
1,3-Dichlorobenzene	0.0003	1.52E-06	0.09	1.69E-05	6.51E-07	-	NA
Benzene	0.0002	3.60E-07	-	NA	1.54E-07	0.029	4.48E-09
Carbon Tetrachloride	0.0003	4.73E-07	0.0007	6.76E-04	2.03E-07	0.13	2.64E-08

Table 6-24

TOTAL INTAKE AND RISKS FROM DERMAL CONTACT (DURING SHOWERING OR BATHING) WITH GROUNDWATER IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Dermal Contact							
Chlorobenzene	0.0003	7.14E-07	0.02	3.57E-05	3.06E-07	-	NA
Chloroethane	0.0003	1.80E-07	-	NA	7.73E-08	-	NA
Chloroform	0.0003	2.02E-07	0.01	2.02E-05	8.66E-08	0.0061	5.28E-10
Chloromethane	0.0003	9.88E-08	-	NA	4.23E-08	0.013	5.50E-10
Dichlorodifluoromethane	0.0004	3.19E-07	0.2	1.59E-06	1.37E-07	-	NA
Methylene Chloride	0.0002	6.09E-08	0.06	1.02E-06	2.61E-08	0.0075	1.96E-10
Tetrachloroethene	0.0032	1.06E-05	0.01	1.06E-03	4.55E-06	0.051	2.32E-07
Trichloroethene	1.0619	1.17E-03	-	NA	5.03E-04	0.011	5.53E-06
Trichlorofluoromethane	0.0003	3.61E-07	0.3	1.20E-06	1.55E-07	-	NA
Vinyl Chloride	0.0008	4.07E-07	-	NA	1.74E-07	1.9	3.31E-07
m,p-Xylene	0.0003	1.41E-06	2	7.05E-07	6.04E-07	-	NA
			Hazard Index:	**0.042**		**Total Risk:**	**7 E-06**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-25
TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE
FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)$^{-1}$	CARCINOGENIC RISK
Groundwater Ingestion							
METALS							
Aluminum	1.0121	3.29E-02	-	NA	1.41E-02	-	NA
Arsenic	0.0017	5.54E-05	0.0003	1.85E-01	2.37E-05	1.75	4.15E-05
Barium	0.3041	9.88E-03	0.07	1.41E-01	4.24E-03	-	NA
Beryllium	0.0008	2.45E-05	0.005	4.90E-03	1.05E-05	4.3	4.51E-05
Chromium	0.0055	1.80E-04	1	1.80E-04	7.70E-05	-	NA
Cobalt	0.0075	2.44E-04	-	NA	1.04E-04	-	NA
Copper	0.0103	3.33E-04	0.037	9.01E-03	1.43E-04	-	NA
Manganese	0.8203	2.67E-02	0.1	2.67E-01	1.14E-02	-	NA
Nickel	0.0141	4.59E-04	0.02	2.30E-02	1.97E-04	-	NA
Vanadium	0.0042	1.36E-04	0.007	1.94E-02	5.81E-05	-	NA
SVOCs							
Dimethylphthalate	0.0053	1.73E-04	1	1.73E-04	7.43E-05	-	NA
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0030	9.75E-05	30	3.25E-06	4.18E-05	-	NA
Carbon Disulfide	0.5600	1.82E-02	0.1	1.82E-01	7.80E-03	-	NA
tert-butylmethylether	0.0015	4.88E-05	-	NA	2.09E-05	-	NA
VOCs							
1,1,1-Trichloroethane	0.0015	5.00E-05	0.09	5.56E-04	2.14E-05	-	NA
1,1,2-Trichloroethane	0.0003	8.27E-06	0.004	2.07E-03	3.55E-06	0.057	2.02E-07
1,1-Dichloroethane	0.0016	5.35E-05	0.1	5.35E-04	2.29E-05	-	NA
1,1-Dichloroethene	0.0017	5.55E-05	0.009	6.16E-03	2.38E-05	0.6	1.43E-05
1,2,3-Trichlorobenzene	0.0003	8.18E-06	0.01	8.18E-04	3.51E-06	-	NA
1,2,4-Trimethylbenzene	0.0003	8.31E-06	-	NA	3.56E-06	-	NA
1,2-Dichloroethane	0.0009	2.93E-05	-	NA	1.26E-05	0.091	1.14E-06
cis-1,2-Dichloroethene	0.4138	1.35E-02	0.01	1.35E+00	5.76E-03	-	NA
trans-1,2-Dichloroethene	0.0019	6.07E-05	0.02	3.03E-03	2.60E-05	-	NA
1,3-Dichlorobenzene	0.0003	8.22E-06	0.09	9.13E-05	3.52E-06	-	NA
Benzene	0.0002	8.07E-06	-	NA	3.46E-06	0.029	1.00E-07
Carbon Tetrachloride	0.0003	1.01E-05	0.0007	1.45E-02	4.34E-06	0.13	5.64E-07

Table 6-25
TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CONCENTRATION (mg/L)	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Groundwater Ingestion							
Chlorobenzene	0.0003	8.20E-06	0.02	4.10E-04	3.51E-06	-	NA
Chloroethane	0.0003	1.06E-05	-	NA	4.55E-06	-	NA
Chloroform	0.0003	1.07E-05	0.01	1.07E-03	4.58E-06	0.0061	2.79E-08
Chloromethane	0.0003	1.11E-05	-	NA	4.74E-06	0.013	6.17E-08
Dichlorodifluoromethane	0.0004	1.25E-05	0.2	6.25E-05	5.36E-06	-	NA
Methylene Chloride	0.0002	6.37E-06	0.06	1.06E-04	2.73E-06	0.0075	2.05E-08
Tetrachloroethene	0.0032	1.04E-04	0.01	1.04E-02	4.46E-05	0.051	2.28E-06
Trichloroethene	1.0619	3.45E-02	-	NA	1.48E-02	0.011	1.63E-04
Trichlorofluoromethane	0.0003	1.00E-05	0.3	3.33E-05	4.28E-06	-	NA
Vinyl Chloride	0.0008	2.62E-05	-	NA	1.12E-05	1.9	2.13E-05
m,p-Xylene	0.0003	8.29E-06	2	4.15E-06	3.55E-06	-	NA
			Hazard Index:	**2.216**		**Total Risk:**	**3 E-04**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-26

TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (FROM GROUNDWATER DURING SHOWERING) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (showering)	Note: intakes for volatiles are considered equivalent to groundwater ingestion, no separate calculation performed					
METALS						
Aluminum	Vapor inhalation was not considered applicable for this chemical					
Arsenic	Vapor inhalation was not considered applicable for this chemical					
Barium	Vapor inhalation was not considered applicable for this chemical					
Beryllium	Vapor inhalation was not considered applicable for this chemical					
Chromium	Vapor inhalation was not considered applicable for this chemical					
Cobalt	Vapor inhalation was not considered applicable for this chemical					
Copper	Vapor inhalation was not considered applicable for this chemical					
Manganese	Vapor inhalation was not considered applicable for this chemical					
Nickel	Vapor inhalation was not considered applicable for this chemical					
Vanadium	Vapor inhalation was not considered applicable for this chemical					
SVOCs						
Dimethylphthalate	Vapor inhalation was not considered applicable for this chemical					
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethane	Vapor inhalation was not considered applicable for this chemical					
Carbon Disulfide	Vapor inhalation was not considered applicable for this chemical					
tert-butylmethylether	Vapor inhalation was not considered applicable for this chemical					
VOCs						
1,1,1-Trichloroethane	5.00E-05	0.3	1.67E-04	2.14E-05	-	NA
1,1,2-Trichloroethane	8.27E-06	0.004	2.07E-03	3.55E-06	0.056	1.99E-07
1,1-Dichloroethane	5.35E-05	0.1	5.35E-04	2.29E-05	-	NA
1,1-Dichloroethene	5.55E-05	0.009	6.16E-03	2.38E-05	0.175	4.16E-06
1,2,3-Trichlorobenzene	8.18E-06	0.003	2.73E-03	3.51E-06	-	NA
1,2,4-Trimethylbenzene	8.31E-06	-	NA	3.56E-06	-	NA
1,2-Dichloroethane	2.93E-05	-	NA	1.26E-05	0.091	1.14E-06
cis-1,2-Dichloroethene	1.35E-02	0.01	1.35E+00	5.76E-03	-	NA
trans-1,2-Dichloroethene	6.07E-05	0.02	3.03E-03	2.60E-05	-	NA
1,3-Dichlorobenzene	8.22E-06	0.04	2.06E-04	3.52E-06	-	NA
Benzene	8.07E-06	-	NA	3.46E-06	0.029	1.00E-07
Carbon Tetrachloride	1.01E-05	0.0007	1.45E-02	4.34E-06	0.13	5.64E-07

Table 6-26

TOTAL INTAKE AND RISKS FROM VAPOR INHALATION (FROM GROUNDWATER DURING SHOWERING) IN THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	ADD (mg/kg/day)	RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day)^-1	CARCINOGENIC RISK
Vapor Inhalation (showering)	Note: intakes for volatiles are considered equivalent to groundwater ingestion, no separate calculation performed					
Chlorobenzene	8.20E-06	0.005	1.64E-03	3.51E-06	-	NA
Chloroethane	1.06E-05	-	NA	4.55E-06	-	NA
Chloroform	1.07E-05	0.01	1.07E-03	4.58E-06	0.08	3.66E-07
Chloromethane	1.11E-05	-	NA	4.74E-06	0.0063	2.99E-08
Dichlorodifluoromethane	1.25E-05	0.05	2.50E-04	5.36E-06	-	NA
Methylene Chloride	6.37E-06	0.86	7.41E-06	2.73E-06	0.0016	4.37E-09
Tetrachloroethene	1.04E-04	0.01	1.04E-02	4.46E-05	0.018	8.03E-07
Trichloroethene	3.45E-02	-	NA	1.48E-02	0.017	2.51E-04
Trichlorofluoromethane	1.00E-05	0.2	5.00E-05	4.28E-06	-	NA
Vinyl Chloride	2.62E-05	-	NA	1.12E-05	0.29	3.26E-06
m,p-Xylene	8.29E-06	0.086	9.64E-05	3.55E-06	-	NA
		Hazard Index:	**1.388**		**Total Risk:**	**3 E-04**

ADD = Average Daily Dose
RfD = Reference Dose
Hazard quotient = ADD / RfD

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

Table 6-27
SUMMARY OF CRITICAL EFFECTS FOR CHEMICALS WITH HAZARD INDICES >0.001

Chemical	Target Organ	Critical Effect
METALS		
Arsenic	Skin	Keratosis & Hyperpigmentation
Barium	Cardiovascular System	Increased Blood Pressure
Beryllium	None Observed	None Observed
Chromium III	None Observed	None Observed
Copper	Gastrointestinal System	Irritation
Manganese	Lung; and	Respiratory Effects; and
	Central Nervous System	Psychomotor Disturbances
Nickel	Whole Body & Major Organs	Decreased Weight
Vanadium	None Observed	None Observed
Carbon Disulfide	Fetus	Toxicity
VOCs		
1,1,2-Trichloroethane	Blood	Clinical Chemistry Alterations
1,2,3-Trichlorobenzene	Adrenal	Increased Weight
1,1-Dichloroethene	Liver	Lesions
1,2-Dichloroethene (cis)	Blood	Decreased Hematocrit & Hemoglobin
1,2-Dichloroethene (trans)	Blood	Increased Alkaline Phosphatase
Carbon Tetrachloride	Liver	Lesions
Chlorobenzene	Liver	Effects
Chloroform	Liver	Lesions
Tetrachloroethene	Liver	Toxicity

All Data Obtained From HEAST (EPA, 1992b)

Table 6-28
SUMMARY OF HAZARD QUOTIENTS AND HAZARD INDICES BASED ON CRITICAL EFFECT FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	CRITICAL EFFECT	TOTAL FROM SOIL PATHWAYS	TOTAL FROM VAPOR PATHWAYS	GROUNDWATER INGESTION	TOTAL FROM ALL PATHWAYS
Non-carcinogenic effects					
METALS					
Arsenic	S	--	--	0.111	0.111
Barium	Cv	--	--	0.085	0.085
Beryllium	NONE	--	--	0.003	0.003
Chromium	NONE	0.005	--	<0.001	0.005
Copper	GI	<0.001	--	0.005	0.005
Manganese	Lu, Cn	--	--	0.161	0.161
Nickel	D	<0.001	--	0.014	0.014
Vanadium	NONE	--	--	0.012	0.012
TICs					
Carbon Disulfide	F	--	--	0.110	0.110
VOCs					
1,1,2-Trichloroethane	B	--	<0.001	0.001	0.001
1,1-Dichloroethene	Li	--	<0.001	0.004	0.004
cis-1,2-Dichloroethene	B	--	<0.001	0.810	0.810
trans-1,2-Dichloroethene	B	--	<0.001	0.002	0.002
Carbon Tetrachloride	Li	--	<0.001	0.009	0.009
Tetrachloroethene	Li	--	<0.001	0.006	0.006
HAZARD INDEX FOR ALL PATHWAYS (Screening):					1.337

NONE - None Observed

-- Chemical is not a chemical of concern via this pathway

HAZARD INDEX Based on Critical Effect	
Target Organ/Critical Effect (Identifying Code)	Hazard Index
Blood (B)	0.813
Cardiovascular System (Cv)	0.085
Central Nervous System (Cn)	0.161
Decreased Body & Organ Weight (D)	0.014
Fetal Toxicity (F)	0.110
Gastrointestinal System (GI)	0.005
Liver (Li)	0.019
Lung (Lu)	0.161
Skin (S)	0.111

Table 6-29
SUMMARY OF HAZARD QUOTIENTS AND HAZARD INDICES BASED ON CRITICAL EFFECT FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO

CHEMICAL	CRITICAL EFFECT	TOTAL FROM SOIL PATHWAYS	TOTAL FROM VAPOR PATHWAYS	GROUNDWATER PATHWAYS			TOTAL FROM ALL PATHWAYS
				DERMAL	INGESTION	INHALATION	
Noncarcinogenic effects							
METALS							
Arsenic	S	--	--	<0.001	0.185	--	0.185
Barium	Cv	--	--	<0.001	0.141	--	0.141
Beryllium	NONE	--	--	<0.001	0.005	--	0.005
Chromium	NONE	0.021	--	<0.001	<0.001	--	0.021
Copper	GI	<0.001	--	<0.001	0.009	--	0.009
Manganese	Lu, Cn	--	--	<0.001	0.267	--	0.267
Nickel	D	<0.001	--	<0.001	0.023	--	0.023
Vanadium	NONE	--	--	<0.001	0.019	--	0.019
TICs							
Carbon Disulfide	F	--	--	0.009	0.182	--	0.191
VOCs							
1,1,2-Trichloroethane	B	--	--	<0.001	0.002	0.002	0.004
1,2,3-Trichlorobenzene	AG	--	--	<0.001	<0.001	0.003	0.003
1,1-Dichloroethene	Li	--	<0.001	<0.001	0.006	0.006	0.012
cis-1,2-Dichloroethene	B	--	<0.001	0.029	1.345	1.345	2.719
trans-1,2-Dichloroethene	B	--	<0.001	<0.001	0.003	0.003	0.006
Carbon Tetrachloride	Li	--	<0.001	<0.001	0.014	0.014	0.028
Chlorobenzene	Li	--	--	<0.001	<0.001	0.002	0.002
Chloroform	Li	--	<0.001	<0.001	0.001	0.001	0.002
Tetrachloroethene	Li	--	<0.001	0.001	0.010	0.010	0.021
HAZARD INDEX FOR ALL PATHWAYS (Screening):							3.659

NONE = None observed

-- Chemical is not a chemical of concern via this pathway

HAZARD INDEX Based on Critical Effect	
Target Organ/Critical Effect (Identifying Code)	Hazard Index
Adrenal Gland (AG)	0.003
Blood (B)	2.729
Cardiovascular System (Cv)	0.141
Central Nervous System (Cn)	0.267
Decreased Body & Organ Weight (D)	0.023
Fetal Toxicity (F)	0.191
Gastrointestinal System (GI)	0.009
Liver (Li)	0.066
Lung (Lu)	
Skin (S)	0.185

Table 6-30
SUMMARY OF CARCINOGENIC RISKS FOR EACH SCENARIO FOR THE RECTICON/ALLIED STEEL SITE

SCENARIO/PATHWAY	CANCER RISK ESTIMATE	PERCENT CONTRIBUTION	DOMINANT CHEMICALS (Ranked)
CURRENT			
Trespasser			
Dermal Contact	2.5 E-07	84.2%	1) Benzo(b)fluoranthene
Soil Ingestion	4.7 E-08	15.8%	2) Benzo(a)pyrene
Particulate Inhalation	1.0 E-10	0.0%	3) Indeno(1,2,3-cd)pyrene
Vapor Inhalation (Outdoor)	4.7 E-11	0.0%	
Total Risk:	3 E-07		
Offsite Resident			1) Methylene chloride
Vapor Inhalation (Outdoor)	3.8 E-09	1.0%	2) TCE
Groundwater Ingestion	3.6 E-07	99.0%	3) Tetrachloroethene
Total Risk:	4 E-07		
FUTURE			
Onsite Worker			
Dermal Contact	1.4 E-06	0.5%	1) TCE
Soil Ingestion	1.3 E-07	0.0%	2) Beryllium
Particulate Inhalation	4.3 E-10	0.0%	3) Arsenic
Vapor Inhalation (Outdoor)	1.9 E-10	0.0%	
Vapor Inhalation (Indoor)	3.4 E-09	0.0%	
Groundwater Ingestion	2.9 E-04	99.5%	
Total Risk:	3 E-04		
Onsite Resident			
Dermal Contact (soil)	2.9 E-06	0.5%	1) TCE
Soil Ingestion	6.1 E-07	0.1%	2) Beryllium
Particulate Inhalation	2.3 E-09	0.0%	3) Arsenic
Vapor Inhalation (Outdoor)	4.0 E-09	0.0%	
Vapor Inhalation (Indoor)	2.4 E-09	0.0%	
Dermal Contact (bathing)	6.8 E-06	1.2%	
Groundwater Ingestion	2.9 E-04	51.5%	
Vapor Inhalation (showering)	2.6 E-04	46.6%	
Total Risk:	6 E-04		

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1E-06 = 1/1,000,000, or one in a million

0.0% = Contribution is less than 1%.

NOTE: The "Dominant Chemicals" are those that contribute the greatest amount to TOTAL risk.
Cancer risks associated with vapor inhalation were calculated separately for the Recticon and Allied Steel Facilities.
Only the risks from the Recticon facility are shown as it produced the highest risk.

7.0 ENVIRONMENTAL EVALUATION

An ecological assessment is an appraisal of the actual or potential effects of a hazardous waste site on plants and non-domesticated animals. Hicks, *et al.* (1989) suggests that ecological assessments should posses the following elements:

- An inventory of the current status of selected components of the biological community in the area;
- An estimate of the current level of ecological effects associated with the site based on the selected subset of ecological endpoints;
- An estimate of the magnitude and variation of toxic effects; and
- Identification of the extent to which these effects have resulted specifically from the presence of hazardous chemicals (as opposed to other associated effects such as habitat disruption).

It is beyond the scope of this document to evaluate each of these in depth; but the potential for adverse impacts to local habitats or potential data gaps will be identified. Most of the information presented in this section was collected as part of the RI of the site.

The land surrounding the Site is sparsely wooded. Industrial and commercial establishments and single-unit residences exist to the south and west, and farms exist to the north and east, within 0.5 mile of the Site. The Site lies within the drainage basin of the Delaware River. Two surface water bodies are situated in the site vicinity: the Schuylkill River, approximately 0.25 mile east of the Site, and Pigeon Creek, approximately 0.25 mile south of the Site. The Schuylkill River flows to the southeast in the vicinity of the Site.

7.1 ECOSYSTEMS INVESTIGATION

During January 1991, Dames & Moore performed an ecosystems investigation of the Site. It involved:

- Delineation of wetlands;
- Identification of soil types and site vegetation;
- Review of site topography; and
- Review of potential habitats on site.

7.1.1 SITE WETLANDS DELINEATION

The wetlands delineation was performed utilizing the methodology and documentation outlined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetlands Delineation, 1989). This methodology states that a wetland exists if any two of the three following criteria are present:

- Hydric soils;
- Hydrophytic vegetation; and
- Shallow water table.

The wetlands boundary for the site was delineated in the field by Dames & Moore. The wetlands delineated for the Site are limited to a 0.10-acre portion of the Allied Steel facility and are predominantly classified as Emergent wetlands with some Scrub/Shrub wetlands. The wetlands parallel the drainage ditch along the railroad tracks (see Figure C-1).

The vegetation on the majority of the Allied Steel portion of the Site is disturbed on a semi-regular basis by activities associated with normal property maintenance. The vegetation along the eastern edge of the wetlands is an unusual mixture of upland and wetland plant species; this mixture is primarily due to the presence of a large amount of fill that was placed in order to provide a bed for the railroad tracks. The vegetation along the western edge of the wetlands is mowed on a semi-regular basis;

therefore, the vegetation is not very well established. Because of these conditions on this portion of the Site, soils and hydrology were relied upon to accurately delineate the boundary of the wetlands.

The Phoenixville, Pennsylvania, National Wetlands Inventory indicates that no wetlands have been mapped on the Site. The closest inventoried wetland lies approximately 2,500 feet to the east (along the Schuylkill River) and is classified as Riverine, Lower Perennial, Open Water wetland, with a permanent water regime (R20WH). The majority of the wetlands in the vicinity of the Site are associated with the Schuylkill River or Pigeon Creek.

7.1.2 SITE SOIL AND VEGETATION

The USDA Soil Conservation Service (SCS) Soil Survey maps were used in the RI to identify potential habitat type at the site. This information is summarized in Table 7-1. The wetlands identified on the site are related to the presence of a drainage ditch and are not directly associated with a particular soil series. To evaluate vegetation and habitats, the Site was divided into three areas:

- Area 1 (along the drainage ditch);
- Area 2 (the upland portion of the Allied Steel facility); and
- Area 3 (the Recticon facility).

Area 1 is the only wetland that occurs on the Site. It is classified as a Palustrine, Emergent, Nonpersistent (PEM2) wetland. The predominant vegetation in the area delineated as a wetland consists of:

Overstory

- *Acer saccharrinum* (silver maple); and
- *Fraxinum pennsylvanica* (green ash).

Understory

- *Cornus amomum* (silky dogwood).

Groundcover

- *Impatiens capensis* (jewel weed);
- *Rubus pennsylvanicus* (blackberry);
- *Epilobum coloratum* (purple-leaved willow-herb); and
- *Solidago* spp. (goldenrod)

The soils in the delineated wetlands had a profile typical to the one described in Table 7-2.

Area 2 is the upland portion of the Allied Steel facility. This area possesses none of the characteristics necessary to delineate it as a wetland. The predominant vegetation in this area consists of various grass and *Rubus pennsylvanicus* (blackberry), and *Solidago* spp. (goldenrod).

Area 3 is the Recticon facility and is classified as a upland because it possesses none of the characteristics necessary to delineate it as a wetland. The predominant vegetation in this area consists of various grass species and landscaped species. No soil samples were taken in this area because it is an obvious upland.

7.1.3 SITE TOPOGRAPHY AND DRAINAGE

The site topography slopes from the western portion of the Recticon facility, at a maximum elevation of 140 feet above mean sea level (MSL) to the eastern portion of the Allied Steel property, at a minimum elevation of approximately 125 feet MSL. The primary drainage feature of the Site is related to the ditches that drain the areas upgradient of the Site to the tributary of Pigeon Creek located south of the Allied Steel property. The closest stream (Pigeon Creek) lies approximately 1,800 feet southeast of the Site. According to the USGS topographic map, the Schuylkill River lies approximately 2,500 feet east of the Site.

The majority of the land north and east of the Site is actively cultivated. The land to the south and west has been developed with private residences and commercial establishments.

7.2 Public Land Use

One State Game Land (SGL 234) exists approximately 3,500 feet to the east of the Site, on a large meander of the Schuylkill River in Limesick Township, Mongomery County (located across the river from the Site). Within the boundaries of SGL 234 are natural, refuge, and wild areas. The 163-acre state game land is used primarily for food plots, with a small area dedicated to wildlife propagation. Numerous Cooperative Farm Game Lands on which game are harvested exist west and south of the Site, the closest being approximately 1,000 feet west.

7.3 Pennsylvania Scenic Rivers Inventory

The Pennsylvania Scenic Rivers Program, Scenic Rivers Inventory is the first inventory of Pennsylvania waterways established to assess the natural, cultural, aesthetic, historic, scientific, and recreational values of Pennsylvania waterways. This program was revised by the Bureau of Water Resources Management, Division of Rivers and Wetlands Conservation, and the Pennsylvania Wild and Scenic Rivers Task Force: Harrisburg, in April 1990. Each waterway appearing in the inventory was nominated and evaluated on the basis of indigenous quality and unique, outstanding, or irreplaceable values and water quality data. The final verification of the waters' eligibility for inclusion in the Scenic Rivers System depends upon the results of on-site inventory, investigation, and evaluation that will be conducted in conjunction with future scenic river studies.

The Schuylkill River

The Pennsylvania Scenic Rivers System has designated 124.8 miles of the Schuylkill River as part of the system. The portion of the Schuylkill River closest to the Recticon/Allied Steel site is the segment that extends between the Douglasville Bridge and the Norristown Dam (34.2 miles). This segment has

a designation of Modified Recreational use, First Priority - Group A, and is in Water Quality Group 2. These terms may be defined as follows:

- Modified Recreational — This category is the lowest priority designation for rivers or sections of rivers in which the flow may be regulated by upstream control devices. Low dams are permitted in the reach as long as they do not increase the river beyond bank-full width. These reaches are used for human activities that do not subsequently interfere with public use of the streams or enjoyment of their surroundings. This rating also includes a Proposed management Classification.

- First Priority - Group A — This category is a designation given by the Wild and Scenic Rivers Task Force, which represents their recommended priority for detailed study. This designation is the highest on the priority list.

- Water Quality Group 2 — This designation indicates that the waterway does not currently meet State Water Quality Standards, but will meet those standards in 0 to 10 years.

7.4 HABITAT

Based on the review of information presented in the Phase I RI, the Site does not appear to include substantial wildlife habitat. Due to the absence or minor concentrations of semivolatile and volatile organic compounds in surface soil and surface water on the Site, there are no identifiable impacts of the Site on nearby habitat such as the cultivated field to the east of the Allied Steel facility. The wetlands vegetation within the drainage ditch on the Allied Steel site appears to be thriving, with no signs of distress.

Summary

For most of the organic chemicals found on the Site, it does not appear that the Site will adversely affect nearby habitats. Factors that support this assertion include:

- The contamination of significant concern is in groundwater;
- The chemicals of concern are not noted for their bioaccumulation potential; and
- The Site does not provide substantial wildlife habitat (see photographs in Attachment C).

Based on current sampling data, the concentrations of copper and zinc in upgradient and downgradient soil samples may be capable of causing adverse biological effects, as indicated in Long & Morgan, 1990. However, the source and extent of these compounds in soil from surface drainages are not well characterized given the relatively small number and limited spatial distribution of samples. Although it is possible that the copper and zinc concentrations detected in downgradient soil samples are related to site activities, it appears that the elevated levels are equally likely to be related to road surface runoff from Route 724. Sax and Lewis (1987) indicate that copper (listed under copper sulfate) and zinc (under vulcanization) are commonly used in the vulcanization process of rubber and tires. Moreover, background samples were collected in the vicinity of a small residential road and only runoff from this road impacts the ditch in the background sample location. Therfore, the source of elevated levels of copper and zinc in road surface runoff may be related to tire wear.

TABLE 7-1
SOIL SERIES DESCRIPTIONS USED IN WETLANDS DELINEATION IN RI

Soil Series	% Slope On-Site Soil[a]	Erosion
Bucks silt loam (BxB2) Penn silt loam (PmB2) Readington silt loam (RdA)	3-8 3-8 0-3 Off-Site soil near site	Moderate Moderate —
Penn silt loam (PmC2) Brandywine loam (BrB2) Roland silt loam (Rp)	8-15 3-8 —	Moderate Moderate —
[a] Underlain by BxB2, RdA, and PmB2 soils.		

TABLE 7-2
GENERAL SOIL PROFILES FOR WETLANDS DELINEATION

Depth (inches bgs)	AREA		
	1	2	3
0-6 (Area 1) 0-8 (Area 2)	Silty loam with a munsell color of 5YR5/2 mottled with 5YR4/6	Silty loam with a munsell color of 5YR4/6 monochromatic	No samples taken — obvious upland habitat
6-12 (Area 1) 8-16 (Area 2)	Silty loam with a munsell color of 5YR3/2 mottled with 7.5YR4/6	Silty loam with a munsell color of 7.5YR4/6 monochromatic	
12-18 (Area 1) 16-24 (Area 2)	Silt loam with a munsell color of 7.5YR4/2 mottled with 5YR3/3	Silt loam with a munsell color of 5YR3/3 monochromatic	

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ATTACHMENT A
ANALYTICAL RESULTS OF DETECTED CHEMICALS IN SITE MEDIA

Table A-1
Analytical Results of Detected Chemicals in Surface Water at the Allied Steel Facility

Dames & Moore Sample No.	FB	FB	FB	FB	A/SW-1	A/SW-1	A/SW-2	A/SW-2	FB	FB	TB	TB	A/SW-1	A/SW-2
Laboratory Sample No.	12261-001	12261-002	12206-001	12206-001	12261-004	12261-005	12206-002	12206-002	12261-001	12206-001	12261-003	12206-004	12261-004	12206-002
Rocky Mtn. Sample No.	1366901	1366801	1361601	1361401	1366902	1366802	1361602	1361402						
(Units in ug/l)	(Total)	(Dissolved)	(Total)	(Dissolved)	(Total)	(Dissolved)	(Total)	(Dissolved)						
METALS														
Aluminum	33.0 U	33.0 U	33.0 U	33.0 U	2250 J	33.0 U	1550	64.7 J	-	-	-	-	-	-
Barium	3.0 U	3.0 U	3.0 U	3.9 J	55.6 J	30.7 J	51.7 J	31.2 J	-	-	-	-	-	-
Cadmium	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.9 J	4.0 U	-	-	-	-	-	-
Calcium	111 U	111 U	159 JB	327 J	24700	22600	22600 L	20600	-	-	-	-	-	-
Chromium	5.0 U	5.0 U	5.0 U	5.0 U	10.6	5.0 U	6.6 J	5.0 U	-	-	-	-	-	-
Copper	10.0 U	10.0 U	10.0 U	10.0 U	90.2	192	87.6	30.4	-	-	-	-	-	-
Iron	24.0 UL	24.0 U	30.6 JB	24.0 U	2820 JL	79.2 J	2190 L	107	-	-	-	-	-	-
Lead	1.0 UL	1.0 U	1.0 U	1.0 UL	20.6 L	1.0 U	7.4 L	1.0 UL	-	-	-	-	-	-
Magnesium	74.0 U	74.0 U	74.0 U	74.0 U	6030	6850	6310	6000	-	-	-	-	-	-
Manganese	7.0 U	7.0 U	7.0 U	7.0 U	245	156	200	115	-	-	-	-	-	-
Potassium	174 U	174 U	174 U	246 J	6800	9500	6030	5830	-	-	-	-	-	-
Selenium	2.0 UL	2.0 UL	2.0 U	2.0 U	2.0 UL	2.0 UL	2.6 J	2.0 UL	-	-	-	-	-	-
Sodium	1540 U	1540 U	1540 U	1540 UL	41000	48800	38600	39600 L	-	-	-	-	-	-
Vanadium	5.0 U	5.0 U	5.0 U	5.0 U	9.9 J	5.3 J	6.1 J	5.0 U	-	-	-	-	-	-
Zinc	4.0 U	4.0 U	19.5 JB	4.0 U	72.3/19.5 U	24.7	116	41.6	-	-	-	-	-	-
SVOCs														
bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-	-	10 U	10 U	-	-	1 J	10 U
Diethylphthalate	-	-	-	-	-	-	-	-	10 U	10 U	-	-	1 J	10 U
VOCs														
Acetone	-	-	-	-	-	-	-	-	5 J	3 J	6 J	10 U	14 B/6 U	8 JB/3 U

Detected concentrations were compared to detections in blank samples, and were considered as nondetects if appropriate.
e.g., 3 BJ/2 U denotes a sample detected originally at 3 which was changed to a nondetect based on the blank detection of 2.

J - Quantitation is approximate due to limitations identified during the quality control review.
U - Compound was not detected.
B - This result is qualitatively suspect because it was detected in a field and/or laboratory blank at a similar level.
L - Biased low.

" indicates that chemical data were not reported under these sample numbers.
A/SW-1 represents the upgradient sampling location; A/SW-2 represents the downgradient sampling location.

Table A-2
Analytical Results of Detected Chemicals in Surface Soil at the Recticon and Allied Steel Facilities

	Allied Steel				Recticon				Blanks			
Dames & Moore Sample Number	A/SS-3	A/SS-4	A/SS-5	A/SS-6	R/SS-2	R/SS-7A	R/SS-7B	R/SS-7C	TB	FB	TB	FB
Laboratory Sample Number	12268-002	12268-003	12268-004	12268-001	12206-003	12268-005	12268-006	12268-007	12268-008	12268-009	12206-004	12206-001
METALS (mg/kg)												
Aluminum	11500	9870	11400	10800	8450	9500	11600	6290	NA	33 U	NA	33.0 U
Arsenic	2.5 JL	2.0 JL	4.5 L	6.0 L	2.1 JL	0.48 UL	2.6 L	1.4 UJL	NA	2 U	NA	2.0 UL
Barium	155	115	157	178	93.7	93.5	139	92.5	NA	3 U	NA	3.0 U
Beryllium	1.0 J	0.66 U	1.8	2.8	0.77 J	0.68 J	0.83 J	0.52 U	NA	2 U	NA	2.0 U
Cadmium	1.4 U	1.3 U	1.2 U	1.4 J	1.2 U	0.97 U	1 U	1 U	NA	4 U	NA	4.0 U
Calcium	1920	7410	4520	4240	16100	3620	1500	630 J/159 U	NA	150 J	NA	159 JB
Chromium	19.9	32.1	47.6	80.7	75.4	14.8	14.5	9.5	NA	5 U	NA	5.0 U
Cobalt	11.9 J	10.8 J	15.7	15.3 J	12.2 J	9.9 J	14.1	9.8 J	NA	8 U	NA	8.0 U
Copper	43.3 J	211 J	124 J	183 J	92.1 J	20.8 J	16.4 J	4.3 J	NA	10 U	NA	10.0 U
Iron	15800	14300	24400	19600	31000	15700	17000	11600	NA	36.6 J	NA	30.6 J
Lead	60.7 DJ	104 DJ	114 DJ	151 DJ	57.9 DJ	74 DJ	37 DJ	30.2 DJ	NA	1 U	NA	1.0 U
Magnesium	2140 J	5980 J	3900 J	2900 J	5360	3390 J	1830 J	1070 J	NA	74 U	NA	74.0 U
Manganese	969 J	356 J	1500 J	1210 J	768 J	642 J	1310 J	857 J	NA	7 U	NA	7.0 U
Nickel	15.9 J	19.8 J	28.7 J	25.1 J	18.4 J	11.6 J	15.1 J	10.5 J	NA	13 U	NA	13.0 U
Potassium	999 J	1160 J	1180 J	1120 J	1170 J	1070 J	1280 J	639 J	NA	174 U	NA	174 U
Vanadium	24.9	27.8	30.1	30.2	23.7	27.1	25	16.9	NA	5 U	NA	5.0 U
Zinc	111 B/40.2 U	346	513	772	123/40.2 U	83.7 B/40.2 U	92.1 B/40.2 U	38 B/40.2 U	NA	40.2	NA	19.5 J
PAHs (ug/kg)												
2-Methylnaphthalene	590 U	1100 UL	700 DJ	250 J	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Acenaphthylene	230 J	240 DJ	260 DJ	330 J	350 J	140 J	440 UL	430 UL	NA	10 UL	NA	10 U
Anthracene	150 J	220 DJ	320 DJ	270 J	210 J	77 J	440 UL	430 UL	NA	10 UL	NA	10 U
Benzo(a)anthracene	300 J	770 DJ	900 DJ	410 J	1000	200 J	440 UL	430 UL	NA	10 UL	NA	10 U
Benzo(a)pyrene	490 J	900 DJ	770 DJ	660	1200	250 J	440 UL	430 UL	NA	10 UL	NA	10 U
Benzo(b)fluoranthene	1200	2000 DL	1700 DL	1600	1400	560 L	110 J	430 UL	NA	10 UL	NA	10 U
Benzo(g,h,i)perylene	250 J	810 DJ	560 DJ	420 J	690	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Benzo(k)fluoranthene	590 U	1100 UL	950 U	550 U	950	430 U	440 UL	430 UL	NA	10 UL	NA	10 U
Chrysene	520 J	990 DJ	1000 LD	710	1000	250 J	60 J	430 UL	NA	10 UL	NA	10 U
Dibenz(a,h)anthracene	63 J	1100 UL	230 DJ	550 U	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Dibenzofuran	590 U	1100 UL	300 DJ	110 J	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Fluoranthene	720	1600 D	1500 LD	930	1300	270 J	68 J	430 UL	NA	10 UL	NA	10 U
Fluorene	590 U	1100 UL	120 DJ	550 U	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Indeno(1,2,3-cd)pyrene	260 J	1100 DJ	480 DJ	380 J	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Naphthalene	590 U	1100 UL	400 DJ	110 J	410 U	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Phenanthrene	290 J	650 DJ	1600 LD	610	330 J	94 J	440 UL	430 UL	NA	10 UL	NA	10 U
Pyrene	680	1600 D	100 DJ	1000	1200	430 UL	98 J	430 UL	NA	10 UL	NA	10 U

Table A-2
Analytical Results of Detected Chemicals in Surface Soil at the Recticon and Allied Steel Facilities

	Allied Steel				Recticon				Blanks			
Dames & Moore Sample Number	A/SS-3	A/SS-4	A/SS-5	A/SS-6	R/SS-2	R/SS-7A	R/SS-7B	R/SS-7C	TB	FB	TB	FB
Laboratory Sample Number	12268-002	12268-003	12268-004	12268-001	12206-003	12268-005	12268-006	12268-007	12268-008	12268-009	12206-004	12206-001
SVOCs (ug/kg)												
Benzoic Acid	2800 U	5600 UL	260 DJ	2700 U	2000 U	250 J	2100 UL	2100 UL	NA	50 UL	NA	50 U
bis(2-ethylhexyl)phthalate	260 J	930 DJ	540 DJ	220 J	560	72 J	46 J	430 UL	NA	10 UL	NA	10 U
Butylbenzylphthalate	140 J	170 DJ	950 UL	390 J	92 J	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
Di-n-butylphthalate	590 U	1100 UL	950 UL	73 J	99 BJ	430 UL	440 UL	430 UL	NA	10 UL	NA	10 U
VOCs (ug/kg)												
Acetone	18 U	25 B	14 U	33 U	140 J	13 U	13 U	18 B	7 J	7 J	10 U	3 J
Methylene Chloride	3 BJ/2 U	9 U	7 U	11 JD/2 U	6 U	6 JB/2 U	5 JB/2 U	5 JB/2 U	5 U	1 J	5 U	2 J
Trichloroethene	2 J	9 U	7 U	5 J	6 U	7 U	7 U	6 U	5 U	5 U	5 U	5 U

Detected concentrations were compared to detections in blank samples, and were considered as nondetects if appropriate.
e.g., 3 BJ/2 U denotes a sample detected originally at 3 which was changed to a nondetect based on the blank detection of 2.

D - Dilution was required to bring sample into linear calibration range.
J - Quantitation is approximate due to limitations identified during the quality control review.
B - This result is qualitatively suspect because it was detected in a field and/or laboratory blank at a similar level.
U - Compound was not detected.
L - Biased low.
NA - Not applicable.

Table A-3
Analytical Results of Detected Chemicals in Background Surface Soil at the Recticon and Allied Steel Facilities

Sample Number (Units in mg/kg)	Allied Steel				Recticon			
	UPGRADIENT	DOWNGRADIENT			UPGRADIENT			DOWNGRADIENT
	A/SS-3	A/SS-4	A/SS-5	A/SS-6	R/SS-7A	R/SS-7B	R/SS-7C	R/SS-2
METALS								
Aluminum	11500	9870	11400	10800	9500	11600	6290	8450
Arsenic	2.500	2.000	4.500	6.000	(0.480)	2.600	(1.400)	2.100
Barium	155	115	157	178	93.5	139	92.5	93.7
Beryllium	1.000	(0.660)	1.800	2.800	0.680	0.830	(0.520)	0.770
Cadmium	(1.400)	(1.300)	(1.200)	1.400	(0.970)	(1.000)	(1.000)	(1.200)
Calcium	1920	7410	4520	4240	3620	1500	630	16100
Chromium	19.9	32.1	47.6	80.7	14.8	14.5	9.5	75.4
Cobalt	11.9	10.8	15.7	15.3	9.9	14.1	9.8	12.2
Copper	43.3	211	124	183	20.8	16.4	4.3	92.1
Iron	15800	14300	24400	19600	15700	17000	11600	31000
Lead	60.7	104	114	151	74	37	30.2	57.9
Magnesium	2140	5980	3900	2900	3390	1830	1070	5360
Manganese	969	356	1500	1210	642	1310	857	768
Nickel	15.9	19.8	28.7	25.1	11.6	15.1	10.5	18.4
Potassium	999	1160	1180	1120	1070	1280	639	1170
Vanadium	24.9	27.8	30.1	30.2	27.1	25	16.9	23.7
Zinc	111	346	513	772	83.7	92.1	38	123
PAHs								
2-Methylnaphthalene	(0.590)	(1.100)	0.700	0.250	(0.430)	(0.440)	(0.430)	(0.410)
Acenaphthylene	0.230	0.240	0.260	0.330	0.140	(0.440)	(0.430)	0.350
Anthracene	0.150	0.220	0.320	0.270	0.077	(0.440)	(0.430)	0.210
Benzo(a)anthracene	0.300	0.770	0.900	0.410	0.200	(0.440)	(0.430)	1.000
Benzo(a)pyrene	0.490	0.900	0.770	0.660	0.250	(0.440)	(0.430)	1.200
Benzo(b)fluoranthene	1.200	2.000	1.700	1.600	0.560	0.110	(0.430)	1.400
Benzo(g,h,i)perylene	0.250	0.810	0.560	0.420	(0.430)	(0.440)	(0.430)	0.690
Benzo(k)fluoranthene	(0.590)	(1.100)	(0.950)	(0.550)	(0.430)	(0.440)	(0.430)	0.950
Chrysene	0.520	0.990	1.000	0.710	0.250	0.060	(0.430)	1.000
Dibenz(a,h)anthracene	0.063	(1.100)	0.230	(0.550)	(0.430)	(0.440)	(0.430)	(0.410)
Dibenzofuran	(0.590)	(1.100)	0.300	0.110	(0.430)	(0.440)	(0.430)	(0.410)
Fluoranthene	0.720	1.600	1.500	0.930	0.270	0.068	(0.430)	1.300
Fluorene	(0.590)	(1.100)	0.120	(0.550)	(0.430)	(0.440)	(0.430)	(0.410)
Indeno(1,2,3-cd)pyrene	0.260	1.100	0.480	0.380	(0.430)	(0.440)	(0.430)	(0.410)
Naphthalene	(0.590)	(1.100)	0.400	0.110	(0.430)	(0.440)	(0.430)	(0.410)
Phenanthrene	0.290	0.650	1.600	0.610	0.094	(0.440)	(0.430)	0.330
Pyrene	0.680	1.600	0.100	1.000	(0.430)	0.098	(0.430)	1.200

Table A-3
Analytical Results of Detected Chemicals in Background Surface Soil at the Recticon and Allied Steel Facilities

	Allied Steel				Recticon			
	UPGRADIENT	DOWNGRADIENT			UPGRADIENT			DOWNGRADIENT
Sample Number (Units in mg/kg)	A/SS-3	A/SS-4	A/SS-5	A/SS-6	R/SS-7A	R/SS-7B	R/SS-7C	R/SS-2
SVOCs								
Benzoic Acid	(2.800)	(5.600)	0.260	(2.700)	0.250	(2.100)	(2.100)	(2.000)
bis(2-ethylhexyl)phthalate	0.260	0.930	0.540	0.220	0.072	0.046	(0.430)	0.560
Butylbenzylphthalate	0.140	0.170	(0.950)	0.390	(0.430)	(0.440)	(0.430)	0.092
Di-n-butylphthalate	(0.590)	(1.100)	(0.950)	0.073	(0.430)	(0.440)	(0.430)	0.099
VOCs								
Acetone	(0.018)	0.025	(0.014)	(0.033)	(0.013)	(0.013)	0.018	0.140
Trichloroethene	0.002	(0.009)	(0.007)	0.005	(0.007)	(0.007)	(0.006)	(0.006)

Numbers in parentheses are non-detect values.

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Allied Steel										
Sample Number	ASG1-7'	ASG9-6'	ASF11-6'	ASH2-6'	ASK11-4'	ASK16-4'	ASD11-6'	ASD13-6'	ASD15-6'	ASF17-3'	ASJ2-4'
Sample Date	1/9/91	1/9/91	1/10/92	1/10/92	1/10/92	1/10/92	1/11/91	1/11/91	1/11/91	1/11/91	1/11/91
(Units in ug/l)											
Benzene	<0.8	<0.8	<0.8	<0.8	<0.3	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Tetrachloride	0.002	<0.002	<0.002	<0.0003	<0.001	<0.001	<0.0001	<0.00005	0.0001	0.0007	0.0002
Chloroform	<0.02	<0.02	<0.02	<0.002	<0.009	<0.009	<0.001	<0.0005	<0.0005	<0.001	<0.001
Ethylbenzene	<3	<3	<3.0	<3.0	<1.0	<1.0	<0.8	<0.8	<0.8	<0.8	<0.8
Tetrachloroethene	3	<0.002	<0.002	<0.002	<0.0007	<0.0007	<0.0002	<0.0001	0.0003	0.0005	<0.0002
Toluene	<1	<1	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TPHC	<3	<3	<3.0	<3.0	<1	4	2	<0.5	2	7	<0.5
Trichloroethane	0.04	0.08	0.01	0.01	<0.003	<0.003	0.2	0.001	0.0008	0.001	0.0007
Trichloroethene	<0.03	0.01	<0.03	0.4	<0.01	<0.01	0.3	<0.0006	0.001	<0.001	<0.001
Vinyl Chloride	<0.6	<0.6	<0.6	<0.6	<0.2	<0.2	<0.4	<0.4	<0.4	<0.4	<0.4
Xylene	<10	<10	<10.0	<11.0	<4.0	<4.0	1.5	<1.0	<1.0	<1.0	<1.0

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Allied Steel (Continued)										
Sample Number	ASJ7-4'	ASJ9-5'	ASL7-3'	ASA1-4'	ASB5-4.5'	ASB9-3'	ASC1-3'	ASC5-3'	ASC9-3'	ASE1-5'	ASE11-4'
Sample Date	1/11/91	1/11/91	1/11/91	1/14/91	1/14/91	1/14/91	1/14/91	1/14/91	1/14/91	1/14/91	1/14/91
(Units in ug/l)											
Benzene	<0.2	<0.2	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	NA
Carbon Tetrachloride	0.0005	0.0006	0.0005	0.0002	0.0002	0.0001	0.00007	0.0002	ND	0.0004	<0.00005
Chloroform	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	<0.8	<0.8	<0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	NA
Tetrachloroethene	0.0005	0.002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.02	<0.0001	0.01	0.0004
Toluene	<0.5	<0.5	<0.5	5	0.8	<0.2	2	<0.2	<0.2	4	NA
TPHC	20	<0.5	22	40	2	<0.4	4	40	<0.4	7	NA
Trichloroethane	0.0007	0.002	0.0007	0.003	0.001	0.0006	0.0004	0.007	0.001	0.008	0.002
Trichloroethene	0.002	0.008	<0.001	<0.0007	0.01	0.003	<0.0007	0.2	0.004	0.02	0.003
Vinyl Chloride	<0.4	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NA
Xylene	<1.0	<1	<1.0	20	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	NA

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Allied Steel (Continued)										
Sample Number	ASG3-3'	ASG5-2.5'	ASG7-2.5'	ASE11-4'	ASE19A-2.5'	SYSTEM BLANK	ASI3-4'	ASI2-2'	ASJ1-4'	ASJ3-2'	ASJ5-2'
Sample Date	1/14/91	1/14/91	1/14/91	1/15/91	1/15/91	1/24/91	1/24/91	1/24/91	1/24/91	1/24/91	1/24/91
(Units in ug/l)											
Benzene	<0.1	2	<0.1	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	ND	ND	ND	0.0002	0.0002	0.0006	<0.0005	0.0002/<0.0006	<0.00009	0.0003/<0.0006	0.0002/<0.0006
Chloroform	0.0037	0.029	0.0035	<0.0006	<0.0006	<0.001	<0.007	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.4	0.7	<0.4	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	<0.0001	<0.0001	<0.0001	0.002	0.002	<0.0002	<0.0009	<0.0002	<0.0002	<0.0002	<0.0002
Toluene	5	10	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	12	17	16	<0.4	3	<0.6	1	<0.6	<0.6	<0.6	<0.6
Trichloroethane	ND	ND	ND	0.005	0.007	0.003	<0.002	0.001/<0.003	0.002/<0.003	<0.001	0.0006/<0.003
Trichloroethene	<0.0007	<0.0007	<0.0007	0.002	0.05	<0.0008	0.8	<0.0008	0.002	0.04	<0.0008
Vinyl Chloride	<0.2	<0.2	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA
Xylene	6	<0.7	8	<0.7	<0.7	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Allied Steel (Continued)										
Sample Number	ASB3-4'	ASB7-4'	ASB13-3'	ASB15-4'	ASB17-3'	ASC3-4'	ASC7-2.5'	ASC11-4'	ASE19B-3'	ASE19D-3'	ASD17-3'
Sample Date	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91	1/25/91
(Units in ug/l)											
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	0.0005	0.0004	0.0004	<0.0001	0.0004	<0.0001	<0.0001	<0.0007	0.0004	0.0004	<0.0001
Chloroform	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	<0.0002	0.006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.2	<0.0002	<0.0002	<0.0002
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Trichloroethane	0.0007	0.002	0.001	<0.0005	0.002	0.007	0.003	0.08	0.0008	0.0009	0.002
Trichloroethene	<0.001	0.02	0.01	<0.001	0.04	<0.001	0.02	0.3	<0.001	<0.001	0.06
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Allied Steel (Continued)								
Sample Number Sample Date (Units in ug/l)	ASF15-4' 1/25/91	ASJ17-3' 1/25/91	ASJ19-3' 1/25/91	ASK9A-1.5' 1/24/91	ASK9B-3' 1/25/91	ASK10-4' 1/25/91	ASL11-4' 1/25/91	ASK12-1' 1/25/91	ASL12-2' 1/25/91
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	<0.0001	0.0004	<0.0001	0.0002/<0.0006	0.001	0.0003	0.001	0.0004	0.0007
Chloroform	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	<0.3	<0.3	<0.3	<0.6	<0.3	<0.3	<0.3	<0.3	<0.3
Trichloroethane	0.001	0.003	<0.0005	0.0009/<0.003	0.002	0.001	0.005	0.0008	0.001
Trichloroethene	0.006	<0.0001	<0.001	0.03	<0.003	0.4	<0.001	<0.0001	<0.001
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene	<0.3	<0.3	<0.3	<0.6	<0.3	<0.3	<0.3	<0.3	<0.3

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Recticon										
Sample Number	RA7-3'	RA9-3'	RC7-3'	RC9-3'	RD9-3'	RD11-3'	RF9-3'	RF11-3'	RH13-2'	RL11-4'	RG1-3'
Sample Date	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/17/91	1/18/91
(Units in ug/l)											
Benzene	<18.0	<7.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.3
Carbon Tetrachloride	0.03	<0.002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0004	0.0007	0.0002	0.0005
Chloroform	<0.07	0.04	0.007	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.9
Tetrachloroethene	0.02	<0.004	<0.0002	0.0003	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	0.0009	0.0007
Toluene	<18.0	<7.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.6
TPHC	990	720	<1	<1	<1	<1	<1	<1	<1	<1	<0.4
Trichloroethane	0.06	0.05	0.01	0.008	0.01	0.001	0.002	0.001	0.002	0.004	0.0008
Trichloroethene	170	40	0.1	0.06	0.2	<0.001	<0.001	<0.001	<0.001	0.05	0.001
Vinyl Chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
Xylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Recticon (Continued)										
Sample Number	RJ1-2'	RL2-3'	RL6-3'	RL8-3'	RL9-2'	RL15-3'	RB11-5'	RC3-4'	RD1-4'	RD13-5'	RF13A-3'
Sample Date	1/18/91	1/18/91	1/18/91	1/18/91	1/18/91	1/18/91	1/21/91	1/21/91	1/21/91	1/21/91	1/21/91
(Units in ug/l)											
Benzene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Tetrachloride	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0002	<0.00009	0.0004	<0.00009	0.0002	0.0008
Chloroform	<0.001	<0.001	0.002	0.006	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.7	<0.7	<0.7	<0.7	<0.7
Tetrachloroethene	0.0009	0.002	0.001	0.002	0.004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	0.0005
Toluene	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	1	2	1	1	1
TPHC	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<1	2	<1	<1	<1
Trichloroethane	0.002	0.0007	0.003	0.03	0.06	0.009	0.003	0.001	0.02	0.0006	0.002
Trichloroethene	0.03	<0.001	0.007	0.9	2	0.07	0.03	0.1	0.002	<0.0008	<0.0008
Vinyl Chloride	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.5	<0.5	<0.5	<0.5	<0.5
Xylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Recticon (Continued)										
Sample Number	RF13B-3'	RF15-4'	RG2-3'	RH3-4'	RH5-6'	RJ5-5'	SYSTEM BLANK	RA1-4'	RA3-3'	RA5-2'	RA6A-3'
Sample Date	1/21/91	1/21/91	1/21/91	1/21/91	1/21/91	1/21/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91
(Units in ug/l)											
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	0.0007	0.0008	<0.001	<0.01	<0.00009	<0.00009	<0.0001	<0.0001	0.001	0.0007	0.02
Chloroform	<0.001	<0.001	0.05	<0.1	0.07	<0.001	<0.001	<0.001	0.003	<0.001	<0.1
Ethylbenzene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	0.0003	0.0003	0.007	0.03	0.003	0.001	<0.0002	<0.0002	0.006	<0.0002	<0.01
Toluene	1	1	<0.3	<0.3	0.3	1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	<1	<1	3	5	4	2	<0.5	<0.5	4	<0.5	11
Trichloroethane	0.001	0.001	0.2	1	0.03	0.006	<0.0005	<0.0005	0.02	0.004	0.05
Trichloroethene	0.0009	0.004	6	6	2	0.01	<0.001	0.007	2	0.2	33
Vinyl Chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA	NA
Xylene	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

	Recticon (Continued)									
Sample Number	RA7A-6'	RB13-5'	RC1-4'	RC5-2.5'	RE13-6'	RF13C-1.5'	RJ7-2'	RJ9-2'	SYSTEM BLANK	RH1-3'
Sample Date	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/24/91	1/24/91
(Units in ug/l)										
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	<0.01	<0.0001	0.0007	0.001	<0.0001	0.0006	<0.0001	<0.0001	0.0006	0.0006/<0.0006
Chloroform	<0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
Tetrachloroethene	<0.02	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	6	<0.5	<0.5	4	<0.5	<0.5	<0.5	<0.5	<0.6	<0.6
Trichloroethane	<0.05	0.001	0.002	0.01	<0.0005	0.0009	0.001	0.001	0.003	0.002/<0.003
Trichloroethene	50	0.9	<0.001	6	<0.001	<0.001	0.006	0.05	<0.0008	0.03
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6	<0.6

Table A-4
Analytical Results of Detected Chemicals in Soil Vapor at the Recticon and Allied Steel Facilities

Sample Number Sample Date (Units in ug/l)	Recticon (Continued)										
	RH7-2' 1/24/91	RH9-3' 1/24/91	RH15-3.5' 1/24/91	RI1-5' 1/24/91	RJ3-4' 1/24/91	RJ11-4' 1/24/91	RJ15-4' 1/24/91	RL1-3' 1/24/91	RL3-5' 1/24/91	RL5-5' 1/24/91	RL13-2' 1/24/91
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	0.0004/<0.0006	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	0.0002/<0.0006	0.0005/<0.0006
Chloroform	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002	<0.0002	<0.0002
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPHC	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Trichloroethane	0.007/<0.003	0.0007/<0.003	0.001/<0.003	0.002/<0.003	0.1	0.006/<0.003	0.003/<0.003	0.001/<0.003	0.0009/<0.00	0.002/<0.003	0.003/<0.003
Trichloroethene	<0.0008	0.002	<0.0008	<0.0008	<0.0008	0.06	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6

System blanks were compared only to samples taken on the same day as the system blank.

Detected concentrations were compared to detections in blank samples, and were considered as nondetects if appropriate.
e.g., 0.007/<0.003 denotes a sample detected originally at 0.007 which was changed to a nondetect based on the blank detection of 0.003.

ND - No detection limit was established for this chemical.
NA - Not analyzed.

Table A-5
Analytical Results of Detected VOCs in Air* at the Recticon and Allied Steel Facilities

Sample Date (Units in ug/l)	Benzene	Carbon Tetrachloride	Chloroform	Ethylbenzene	Tetrachloroethene	Toluene	TPHC	Trichloroethane	Trichloroethene	Vinyl Chloride	Xylene
1/10/92	<0.3	0.0008	<0.0006	<1.0	<0.0007	<0.5	<1.0	0.002	<0.0009	<0.2	<4.0
1/10/92	<0.3	0.02	<0.009	<1.0	<0.0007	<0.5	<1.0	0.03	<0.01	<0.2	<4.0
1/10/92	<0.3	0.0004	<0.009	<1.0	<0.0007	<0.5	7	<0.003	<0.01	<0.2	<4.0
1/11/91	<0.2	0.0002	<0.001	<0.8	0.001	<0.5	50	0.0007	<0.001	<0.4	<1.0
1/14/91	<0.1	0.0003	<0.0005	<0.4	0.001	<0.2	3	0.0007	<0.0007	<0.2	<0.7
1/15/91	<0.2	<0.00004	<0.0006	<0.4	<0.00009	<0.2	<0.4	<0.0002	<0.0005	<0.2	<0.7
1/17/91	<0.4	0.0006	<0.001	<0.8	<0.0002	<0.4	<1	0.002	<0.001	<0.5	<1
1/17/91	<0.4	0.0005	<0.001	<0.8	<0.0002	<0.4	<1	0.001	<0.001	<0.5	<1
1/18/91	<0.3	0.0004	<0.001	<0.9	<0.0002	<0.6	10	<0.0004	<0.001	<0.6	<1
1/21/91	<0.2	0.0008	<0.001	<0.7	0.003	2	2	0.002	<0.0008	<0.5	<1
1/21/91	<0.2	0.0005	<0.001	<0.7	<0.0002	2	7	0.003	<0.0008	<0.5	<1
1/23/91	<0.05	<0.0001	<0.001	<0.2	<0.0002	<0.1	<0.5	<0.0005	<0.001	NA	<0.5
1/23/91	<0.05	<0.0001	<0.001	<0.5	<0.0002	<0.1	<0.5	<0.0005	<0.001	NA	<0.5
1/24/91	<0.05	0.0008	<0.001	<0.2	<0.0002	<0.1	<0.6	0.002	<0.0008	NA	<0.6
1/24/91	<0.05	<0.00009	<0.001	<0.2	<0.0002	<0.1	<0.6	<0.0004	<0.0008	NA	<0.6
1/25/91	<0.05	0.0007	<0.001	<0.2	<0.0002	<0.1	<0.3	0.002	<0.001	NA	<0.3
1/25/91	<0.05	0.0004	<0.001	<0.2	<0.0002	<0.1	<0.3	0.003	<0.001	NA	<0.3

*These samples were used only to calibrate soil gas equipment and were not intended to support quantitative risk estimates.

Table A-6
Analytical Results of Detected Chemicals in Subsurface Soil at the Recticon and Allied Steel Facilities

Dames & Moore Sample No.	Blanks				Allied Steel						
Sample Depth	FB	FB	TB	TB	A/C5 4-6'	A/C5 14-16'	A/C5 16-18'	A/C5 18-20'	A/C11 16-18'	A/H2 10-12'	A/K9A 8-10'
Enseco Laboratory Sample No.	12262-007	12205-003	12139-007	12262-008	12139-004	12139-003	12139-002	12139-001	12262-001	12139-006	12139-005
Rocky Mtn. Sample No.	13670 01	13615 01			1353904	1353903		1353902	1367201	1353906	1353905
Units	mg/l	mg/l	-	-	mg/kg	mg/kg	-	mg/kg	mg/kg	mg/kg	mg/kg
METALS											
Aluminum	33.0 U	65.8 J	-	-	4990	8200	-	4040	5430	6460	4830
Arsenic	2.0 UL	2.0 UL	-	-	2.0 L	1.51 L	-	2.7 L	1.2 L	1.5 L	2.1 L
Barium	3.0 UJ	6.7 J	-	-	32.2 J	50.3 J	-	47.5 J	65.4 J	106 J	97.1 J
Beryllium	2.0 U	2.0 U	-	-	0.49 U	0.49 U	-	0.44 U	0.48 J	0.49 J	0.59 B
Calcium	213 J	1010 J	-	-	1190 J	998 J	-	329 J	453 J	424 J	540 J
Chromium	5.0 U	5.0 U	-	-	21.4	12.4	-	17.9	12.6	21.7	21.7
Cobalt	8.0 U	8.0 U	-	-	13.2	11.2 J	-	5.9 J	10.1 J	15.7	9.9 J
Copper	10.0 U	10.0 U	-	-	16.3	18.4	-	22.4	9.8	9.9	9.7
Iron	24.0 UJ	61.7 J	-	-	15200 J	18300 J	-	11600 J	13600 J	21600 J	15100 J
Lead	1.0 U	2.5 K	-	-	15.3 K	12.3 K	-	5.3 K	7.9 K	7.2 K	10.1 K
Magnesium	74.0 U	100 J	-	-	953 J	1500 J	-	1400 J	1610 J	1350 J	1090 J
Manganese	7.0 UJ	7.0 UJ	-	-	619 J	494 J	-	330 J	747 J	1000 J	584 J
Nickel	13.0 U	13.0 U	-	-	7.3 J	10.9	-	9.2	9.7	13.2	9.4
Potassium	174 U	174 U	-	-	855 J	1050 J	-	496 J	613 J	807 J	754 J
Vanadium	5.0 U	5.0 U	-	-	16.1	19.3	-	14	18.1	23.2	20.6
Zinc	4.0 UJ	6.4 J	-	-	22.4 J	36.0 J	-	24.2 J	21.8 J	30.6 J	24.9 J
Units	ug/l	ug/l	-	-	ug/kg	ug/kg	-	ug/kg	ug/kg	ug/kg	ug/kg
SVOCs											
bis(2-Ethylhexyl)phthalate	10 U	4 J	-	-	410 UL	450 UL	-	360 UL	410 UL	330 UL	62 JL
Di-n-butylphthalate	10 U	10 U	-	-	410 UL	450 UL	-	360 UL	410 UL	330 UL	390 UL
Units	ug/l	ug/l	ug/l	ug/l	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
VOCs											
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	6 U	7 U	5 U	5 U	6 U	10 U	6 U
Acetone	5 JB	5 J	4 JB	7 JB	13 U	14 U	11 U	11 U	12 U	20 U	12 U
Benzoic Acid	50 U	50 U	-	-	54 JL	120 JL	-	50 JL	2000 UL	1600 UJL	49 JL
Methylene Chloride	1 JB	5 U	5 U	5 U	6 U	7 U	5 U	1 J	6 U	10 U	6 U
Trichloroethene	5 U	5 U	5 U	5 U	6 U	7 U	5 U	5 U	6 U	10 U	2 J

Table A-6
Analytical Results of Detected Chemicals in Subsurface Soil at the Recticon and Allied Steel Facilities

	Recticon									
Dames & Moore Sample No.	R/A7A	R/A7*	R/A7	R/G2	R/H3	R/H3	R/H3	R/L9	R/L9	R/L9
Sample Depth	6-8'	9.5-11'	18.5-20'	8-10'	8-10'	8-10-12'	12-14' 14-16' (Composite)	16-18'	16-18' 18-20' (Composite)	18-20'
Enseco Laboratory Sample No.	12262-002	12205-001	12205-002	12262-003	12262-004	12262-005	12262-006	12048-001	12048-003	12048-002
Rocky Mtn. Sample No.	1367202	1361701	1361702	1367203			1367204		1353901	1353907
Units	mg/kg	mg/kg	mg/kg	mg/kg	-	-	mg/kg	-	mg/kg	mg/kg
METALS										
Aluminum	9440	7580	2290	8250	-	-	4270	-	9150	NR
Arsenic	0.81 L	2.2 L	0.46 UL	0.45 UL	-	-	0.45 UL	-	1.6 JL	NR
Barium	62.3 J	68.3 J	38.3 J	317 J	-	-	225 J	-	181 J	NR
Beryllium	0.93 J	0.43 U	0.46 U	1.3	-	-	0.85 J	-	0.71 J	NR
Calcium	1480	344 J	269 J	443 J	-	-	308 J	-	460 J	NR
Chromium	15.2	16.5	2.6	8.9	-	-	6.6	-	11.6	NR
Cobalt	11.9	10.4 J	4.7 J	15.1	-	-	7.3 J	-	9.4 J	NR
Copper	11.9	9.7	4.7 J	2.3 U	-	-	2.6 J	-	16.3	NR
Iron	17500 J	14600 J	2300 J	9130 J	-	-	5240 J	-	18800 J	NR
Lead	4.4 K	7.1 K	1.1 K	15.7 K	-	-	3.2 K	-	6.6 K	NR
Magnesium	2130 J	758 J	189 J	2360 J	-	-	521 J	-	1860 J	NR
Manganese	439 J	410 J	270 J	1450 J	-	-	1100 J	-	346 J	NR
Nickel	18.9	5.3 J	3.3 J	31.7	-	-	12.1	-	10.4	NR
Potassium	1380	502 J	203 J	1060 J	-	-	575 J	-	786 J	NR
Vanadium	20.8	20.1	4.1 J	8.4 J	-	-	9.1 J	-	22.2	NR
Zinc	38.5 J	18.1 J	6.4 J	46.9 J	-	-	16.4 J	-	37.1 J	NR
Units	ug/kg	ug/kg	ug/kg	ug/kg	-	ug/kg	-	ug/kg	-	-
SVOCs										
bis(2-Ethylhexyl)phthalate	390 U	360 U	350 U	370 U	-	390 U	-	420 UL	-	-
Di-n-butylphthalate	390 U	160 BJ	350 U	370 U	-	390 U	-	420 UL	-	-
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	-	ug/kg	-	-
VOCs										
1,2-Dichloroethene (total)	6 U	48 DJ; 47	5 U	6 U	6 U	-	-	6 U	-	-
Acetone	9 JB	11 U	12 B	114	10 JB	-	-	13 U	-	-
Benzoic Acid	1900 U	1800 U	1700 U	1800 U	-	1900 U	-	99 JL	-	-
Methylene Chloride	3 JB	5 U	5 U	3 JB	6 U	-	-	6 U	-	-
Trichloroethene	6 U	400 D; 910	5 U	6 U	14	-	-	7	-	-

" - " indicates that chemical data were not reported under these sample numbers.
* Samples from RA/7 (9.5 - 11') were analyzed twice for some chemicals.
D - Dilution was required to bring sample into linear calibration range.
J - Quantitation is approximate due to limitations identified during the quality conrol review.
B - This result is qualitatively suspect because it was detected in a field and/or laboratory blank at a similar level.
U - Compound was not detected.
L - Biased low.
E - Exceeds linear calibration range.
K - Biased high.
NR - Not required.

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	4/2/91									
Dames & Moore Sample Number	TB	FB	OB-1	OB-2	OB-3	OB-4	OB-5	OB-6	OB-7	OB-8
Laboratory Sample Number	13072 -001	13072 -002	13072 -004	13072 -003	13072 -006	13072 -007	13072 -008	13072 -010	13072 -005	13072-009
(Units in ug/l)										
METALS (total)										
Aluminum	ND	26 U	2,140	1740	2800	4060	16600	2010	7730	1520
Antimony	ND	16 U	16 U	16 U	16 U	16 U	16 U	16 U	16 U	16 U
Arsenic	ND	2 U	2 U	2 U	3.0 JL	2 U	3.8 JL	2 U	2 U	2 U
Barium	ND	2 U	103 J	250	195 J	148 J	205	40.2 J	97.9 J	95.7 J
Beryllium	ND	1 U	1 U	1.5 JB	2.2 JB	1.2 JB	1.6 J	2.8 JB	1.2 JB	1 U
Calcium	ND	310 J	41400	10600	9670	10800	11100	18500	18000	11900
Chromium	ND	6 U	37.9	6 U	24.8	7.6 J	25.4	6 U	15.3	6 U
Cobalt	ND	4 U	4 U	5.9 J	112	6.8 J	20.0 J	22.4 JB	13.2 J	4 U
Copper	ND	6 U	13.3 JB	8.6 J	16.2 JB	8.4 JB	27.6 B	8.5 JB	19.2 JB	6.8 JB
Iron	ND	20 U	2,210	2520	21900	6030	30300	1320	12200	2110
Lead	ND	7.2	3.7 BL/7.2 U	7.9 B/7.2 U	18.6 B/7.2 U	3.3 B/7.2 U	17.3 BL/7.2 U	1.5 JBL/7.2 U	14.0 B/7.2 U	2.7 JBL/7.2 U
Magnesium	ND	66 U	8740	7770	12500	6290	13100	10800	7360	11400
Manganese	ND	7 U	462	976	3750	539	1220	1350	556	128
Nickel	ND	7 U	24.8 J	14.2 J	60	14.2 J	42.9	29.3 J	21.2 J	18.2 J
Potassium	ND	103 U	13900	2860 J	4760 J	4420 J	4320 J	2510 J	4490 J	3700 J
Selenium	ND	2 UL	20 ULD	2 UL	2 UL	2 UL	20 UDL	2 UL	2 UL	20 ULD
Sodium	ND	1230 U	35600	11200	5780	6840	28400	19700	8940	30100
Vanadium	ND	4 U	4 U	4 U	27.6 J	6.5 J	35.2 J	4 U	12 J	4 U
Zinc	ND	22.4	55 B/22.4 U	82.7 B/22.4 U	107 B/22.4 U	48.6 B/22.4 U	99.2 B/22.4 U	74.3 B/22.4 U	98.4 B/22.4 U	19.3 JB/22.4 U
METALS (dissolved)										
Aluminum	ND	26 U	26 U	26 U	26 U	26 U	26 U	671	26 U	26 U
Antimony	ND	16 U	16 U	16 U	16 U	16 U	17.5 J	16 U	16 U	16 B
Arsenic	ND	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL
Barium	ND	2 U	58.5 J	117 J	52.6 J	72.8 J	57.2 J	27.5 J	27.8 J	73.3 J
Beryllium	ND	1 U	1 U	1 U	1 U	1 U	1 U	2.4 J	1 U	1 U
Calcium	ND	246 JB	28400	10200	8750	9900	10400	18700	17300	11500
Chromium	ND	6 U	6.1 J	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Cobalt	ND	4 U	4 J	4 U	84.9	4 U	4 U	20.6 J	4 U	4 U
Copper	ND	10 U	12.3 J	10 U	15.6 J	10 U	14.6 J	18.4 J	11.7 J	17.5 J
Iron	ND	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Lead	ND	1 U	1 UL	1 U	1 UL	1 UL	1 UL	1 UL	1 UL	1 UL
Magnesium	ND	66 U	7610	7280	9,210	5190	9160	10500 K	5310	10100
Manganese	ND	7 U	284 K	333 K	2960 K	275 K	53.5 K	1340	128 K	321 K
Nickel	ND	7 U	7 U	9.3 J	32.5	7 U	13.7 J	29.7 J	7 U	9.7 J
Potassium	ND	103 U	13300	5240	5,190	5,700	3500 J	2570 J	3510 J	5590 J
Selenium	ND	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2.1 JL	2 UL
Sodium	ND	1230 UJ	32800 J	10000 J	5720 J	6480 J	29400 J	18000 J	7860 J	25600 J
Vanadium	ND	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	ND	11.9 JB	15.5 JB/11.9 U	37.7 B/11.9 U	49.2 B/11.9 U	55.9 B/11.9 U	55.3 B/11.9 U	97.7	48.2 B/11.9 U	46.1 B/11.9 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	4/2/91									
Dames & Moore Sample Number	TB	FB	OB-1	OB-2	OB-3	OB-4	OB-5	OB-6	OB-7	OB-8
Laboratory Sample Number	13072 -001	13072 -002	13072 -004	13072 -003	13072 -006	13072 -007	13072 -008	13072 -010	13072 -005	13072-009
(Units in ug/l)										
SVOCs										
bis(2-ethylhexyl)phthalate	ND	10 U	22	2 J	10 U	1 J	10 U	10 U	1 J	2 J
Dimethylphthalate	ND	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TICs										
1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylmethylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOCs										
1,1,1-Trichloroethane	0.50 U	0.50 U	0.070 J	1.1	0.50 U	0.050 J	2.4	0.070 J	0.14 JB	2.9
1,1,2-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	0.50 U	0.50 U	0.59	0.50 U	0.50 U	2.5	0.15 J	0.50 U	3.1
1,1-Dichloroethene	0.50 U	0.50 U	0.50 U	0.77	0.50 U	0.50 U	0.28 J	0.50 U	0.50 U	0.30 J
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.15 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	0.11 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.21 JB/0.11 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	0.50 U	0.50 U	0.18 J	0.50 U	0.50 U	2.9	0.50 U	0.50 U	3.5
cis-1,2-Dichloroethene	0.50 U	0.50 U	3.1	190 D	0.11 J	0.66	53 D	0.31 J	0.29 J	120 D
trans-1,2-Dichloroethene	0.50 U	0.50 U	0.50 U	0.19 J	0.50 U	0.50 U	0.33 J	0.50 U	0.50 U	0.22 J
1,3-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	0.070 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.12 J	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.50 U	0.50 U	0.50 U	0.16 J	0.50 U	0.50 U	0.060 J	0.50 U	0.50 U	0.080 J
Chloromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	0.12 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.17 J	0.12 J	0.14 JB/0.17 U	0.23 JB/0.17 U	0.50 U	0.15 JB/0.17 U	0.99 B/0.17 U	0.50 U	0.11 JB/0.17 U	1.2 B/0.17 U
Naphthalene	0.37 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	0.08 J	0.50 U	0.50 U	0.50 U	0.50 U	0.12 JB/0.08 U	13	1.8	0.23 JB/0.08 U
Toluene	0.50 U	0.11 J	0.25 JB/0.11 U	0.50 U	0.060 J/0.11 U	0.13 JB/0.11 U	0.25 JB/0.11 U	0.50 U	0.080 JB/0.11 U	0.50 U
Trichloroethene	0.50 U	0.10 J	100 D	1,100 D	0.59 J	7.7	510 D	1.9	7.3	1,200 D
Trichlorofluoromethane	0.50 U	0.25 J	0.50 U	0.090 JB/0.25 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.060 JB/0.25 U
Vinyl Chloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.080 J	0.50 U	0.50 U	0.50 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	4/2/91 (Continued)							
Dames & Moore Sample Number	BR-1	BR-2	BR-3	BR-4	BR-5	BR-6	BR-7	BR-8
Laboratory Sample Number	13072 -012	13072 -013	13072 -014	13072 -015	13072 -018	13072 -017	13072 -016	13072-019
(Units in ug/l)								
METALS (total)								
Aluminum	2290	170 J	303	108 J	391	80.4 J	322	524
Antimony	16 U	16 U	16 U	16 U	16 U	16 U	16 U	16 U
Arsenic	2.1 J	2 U	2.4 J	2 U	2 U	2 U	2 U	2 U
Barium	273	232	280	283	361	180 J	119 J	301
Beryllium	1.2 JB	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Calcium	13600	11200	13500	16100	15300	11300	14100	13500
Chromium	6.7 J	6 U	6 U	6 U	6.4 J	6 U	6 U	6.4 J
Cobalt	6.7 JB	4 U	8.3 JB	7.5 JB	4.3 J	5.5 J	4 U	9.1 J
Copper	10.3 JB	10.8 JB	9.7 JB	8.9 JB	9.6 JB	10.7 JB	7.3 JB	7.4 JB
Iron	31400	41100	36300	37300	14300	37300	6910	7330
Lead	2.8 JB/7.2 U	2.6 JB/7.2 U	1 U	1.4 JBL/7.2 U	3.0 B/7.2 U	1 UL	3.2 B/7.2 U	6.2 B/7.2 U
Magnesium	11300	7610	9010	10200	9060	7990	9450	7620
Manganese	458	303	597	1,420	205	709	224	542
Nickel	19.7 J	7 U	11.6 J	8.1 J	9.6 J	8.6 J	15.7 J	9.6 J
Potassium	5080	3030 J	3250 J	3000 J	2890 J	1950 J	4740 J	1820 J
Selenium	2 UL	2 UL	2 UL	20 ULD	20 ULD	2 UL	2 UL	2 UL
Sodium	12300	11700	13400	17200	18800	15000	20800	17300
Vanadium	8.0 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	51.8 B/22.4 U	26.8 B/22.4 U	37 B/22.4 U	24.6 B/22.4 U	17.3 JB/22.4 U	26.2 B/22.4 U	26.1 B/22.4 U	30.9 B/22.4 U
METALS (dissolved)								
Aluminum	26 U	26 U	26 U	26 U	26 U	26 U	26 U	26 U
Antimony	16 U	16 U	16 U	16 U	16 U	16 U	16 U	19.1 J
Arsenic	2 U	2 UL	2 UL	2 UL	2 U	2 U	2 U	2 U
Barium	188	20 B	261	226	318	164 J	114 J	263
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Calcium	12700	10900	13300	13400	14600	11300	13900	12900
Chromium	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Cobalt	4 U	4.0 U	4.6 B	4 U	4 U	4 U	4 U	4 U
Copper	12.9 J	10 U	10 U	10 U	10.1 J	10 U	10.3 J	10 U
Iron	2840	18300	25900	17700	3190	23000	2850	2690
Lead	1 U	1 UL	1 UL	1 UL	4.5	1 U	1 U	1 U
Magnesium	9480 K	7410 K	8950 K	8530 K	8210 K	7850	9350 K	7000 K
Manganese	209	279	558	1200	159	702	195	460
Nickel	10.7	7.0 J	10.2 J	7 U	9.3 J	7 U	15.1 J	8.8 J
Potassium	4930 J	4180 J	3820 J	3270 J	4080 J	4020 J	5310	2070 J
Selenium	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL	2 UL
Sodium	12700 J	11300 J	13200 J	11100 J	16500 J	14400 J	20200 J	16100 J
Vanadium	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	66.7	41.9 B/11.9 U	30.2 B/11.9 U	33.4 B/11.9 U	27.8 B/11.9 U	29.5 B/11.9 U	38.7 B/11.9 U	56.7 B/11.9 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	4/2/91							
Dames & Moore Sample Number	BR-1	BR-2	BR-3	BR-4	BR-5	BR-6	BR-7	BR-8
Laboratory Sample Number	13072 -012	13072 -013	13072 -014	13072 -015	13072 -018	13072 -017	13072 -016	13072-019
(Units in ug/l)								
SVOCs								
bis(2-ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dimethylphthalate	10 U	2 J	10 U	10 U	10 U	10 U	10 U	10 U
TICs								
1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylmethylether	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND
VOCs								
1,1,1-Trichloroethane	0.50 U	0.39 J	1.2	0.50 U	2.2	0.10 J	1.3	1.9
1,1,2-Trichloroethane	0.50 U	0.50 U	0.3 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	0.50 U	2	0.16 J	1.6	0.12 J	0.75	2
1,1-Dichloroethene	0.50 U	1.3	2.3	0.50 U	1.7	0.50 U	0.50 U	2.8
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.19 J	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.060 JB/0.15 U	0.15 JB/0.15 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.05 J	0.50 U	0.50 U
1,2-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.13 JB/0.11 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	1.2	0.50 U	0.69	0.50 U
cis-1,2-Dichloroethene	0.50 U	270 D	570 D	2.8	430 D	0.38 J	16	730 D
trans-1,2-Dichloroethene	0.50 U	0.24 J	0.81 J	0.50 U	0.86 J	0.50 U	0.50 U	0.73
1,3-Dichlorobenzene	0.50 U	0.50 U	0.05 J	0.50 U	0.50 U	0.070 J	0.50 U	0.50 U
1,4-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.090 JB/0.07 U	0.50 U	0.50 U
Benzene	0.50 U	0.16 J	0.13 J	0.50 U	0.36 J	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.19 J	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	0.50 U	0.18 J	0.50 U	0.36 J	0.50 U	0.50 U	0.41 J
Chloroform	0.55	0.15 J	0.21 J	0.50 U	0.17 J	0.10 J	0.19 J	0.25 J
Chloromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.14 J	0.50 U	0.82	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.17 JB/0.17 U	0.15 JB/0.17 U	0.50 U	0.17 JB/0.17 U	0.74 JB/0.17 U	0.16 JB/0.17 U	0.42 JB/0.17 U	0.24 JB/0.17 U
Naphthalene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	0.50 U	0.11 B/0.08 U	0.50 U	0.50 U	5.5	3.6	0.50 U
Toluene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.06 JB/0.11 U	0.50 U	0.50 U
Trichloroethene	0.8	1,600 D	1,300 D	30	1,500 D	2.6	170 D	1,400 D
Trichlorofluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.06 JB/0.25 U	0.50 U	0.50 U
Vinyl Chloride	0.50 U	2.2	1.4	0.50 U	0.82	0.50 U	0.50 U	0.83
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.07 J	0.50 U	0.50 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	7/10/91								
Dames & Moore Sample Number	FB	TB	OB-2	OB-3	OB-4	OB-5	OB-6	OB-7	OB-8
Laboratory Sample Number	015001-02	015001-017	015001-003	015001-004	015001-006	015001-005	015001-010	015001-011	015001-009
(Units in ug/l)									
TICs									
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylmethylether	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOCs									
1,1,1-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.15	0.38	0.50 U
1,1,2-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	0.50 U	5.1	0.50 U	0.50 U	1.7	0.15	0.50 U	3
1,1-Dichloroethene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	0.50 U	5	0.50 U	0.50 U	2.5	0.50 U	0.50 U	4.5
cis-1,2-Dichloroethene	0.50 U	0.71	13	0.50 U	0.50 U	25	0.35/0.71 U	0.26/0.71 U	47
trans-1,2-Dichloroethene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.12	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.50 U	0.50 U	1.6	0.50 U	0.50 U	0.95	0.50 U	0.50 U	1.4
Naphthalene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	14	13	0.4
Toluene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	2.6	3.4	11/3.4 U	0.45/3.4 U	0.41/3.4 U	67	0.88/3.4 U	5.9/3.4 U	240
Trichlorofluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.11	0.50 U	0.50 U	0.50 U	0.50 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	7/10/91 (Continued)							
Dames & Moore Sample Number	BR-1	BR-2	BR-3	BR-4	BR-5	BR-6	BR-7	BR-8
Laboratory Sample Number	015001-007	015001-001	015001-013	015001-008	015001-012	015001-014	015001-015	015001-016
(Units in ug/l)								
TICs								
1,1,2-Trichloro-1,2,2-trifluoroethan	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylmethylether	ND	ND	ND	ND	ND	ND	ND	ND
VOCs								
1,1,1-Trichloroethane	0.50 U	50 U	0.50 U	0.29	2.1	0.50 U	1	2.1
1,1,2-Trichloroethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	50 U	2.2	0.48	5 U	0.50 U	0.56	2
1,1-Dichloroethene	0.50 U	50 U	2.9	0.19	5 U	0.50 U	0.50 U	2.7
1,2,3-Trichlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	0.50 U	170	680	14	200	1.8/0.71 U	12	700
trans-1,2-Dichloroethene	0.50 U	50 U	0.64	0.50 U	5 U	0.50 U	0.50 U	8.4
1,3-Dichlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Benzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.15
Carbon Tetrachloride	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.47
Chloroform	0.50 U	50 U	0.26	0.50 U	5 U	0.50 U	0.50 U	0.2
Chloromethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.19	50 U	0.50 U	0.50 U	4.2	0.21	0.50 U	0.50 U
Naphthalene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	50 U	0.16	0.50 U	5 U	6.6	4.3	0.50 U
Toluene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Trichloroethene	0.46/3.4 U	940	1900	150	970	5.4/3.4 U	90	1400
Trichlorofluoromethane	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.50 U	50 U	2	0.50 U	5 U	0.50 U	0.50 U	0.93
m,p-Xylene	0.50 U	50 U	0.50 U	0.50 U	5 U	0.50 U	0.50 U	0.50 U

Table A-7

Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	9/17/91-9/18/9							
Dames & Moore Sample Number	TB	FB	OB-2	OB-4	OB-5	OB-6	OB-7	OB-8
Laboratory Sample Number	16262-001	16262-008	16262-002	16262-003	16262-004	16262-005	16262-006	16262-007
(Units in ug/l)								
TICs								
1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	3.1 JB	13 JB	17 JB/13 U	4.9 JB/13 U	2.9 JB/13 U	3.9 JB/13 U	1.3 JB/13 U	6.8 JB/13 U
tert-butylmethylether	ND	ND	1.2 J	ND	ND	ND	ND	0.72 J
VOCs								
1,1,1-Trichloroethane	0.50 U	0.50 U	6.2	0.50 U	1.7	0.11 J	0.11 J	3
1,1,2-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	0.50 U	10	0.50 U	2.3	0.090 J	0.50 U	4.1
1,1-Dichloroethene	0.50 U	0.50 U	0.41 J	0.50 U	0.50 U	0.50 U	0.50 U	0.15 J
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	0.50 U	4.7	0.50 U	2.2	0.50 U	0.50 U	4.9
cis-1,2-Dichloroethene	0.50 U	0.50 U	67 D	0.50 U	21	0.35 J	0.13 J	50 D
trans-1,2-Dichloroethene	0.50 U	0.50 U	0.34 J	0.50 U	0.13	0.50 U	0.50 U	0.21 J
1,3-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	0.50 U	0.13 JB	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	0.50 U	0.37 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.16 JB	0.50 U	0.80 JB/0.16 U	0.50 U	0.50 U	0.50 U	0.50 U	0.060 JB/0.16 U
Chloromethane	0.50 U	0.50 U	0.50 U	0.50 U	4.3 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.30 JB	0.19 JB	2.2 B/0.3 U	0.29 JB/0.3 U	0.86 B/0.3 U	0.24 JB/0.3 U	0.36 JB/0.3 U	1.2 B/0.3 U
Naphthalene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	0.50 U	0.17 J	0.50 U	0.070 J	17	3.7	0.080 J
Toluene	0.50 U	0.50 U	0.50 U	0.080 J	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	0.50 U	0.50 U	100 D	0.17 J	48 D	1	2.4	130 D
Trichlorofluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	9/17/91-9/18/91 (Continued)							
Dames & Moore Sample Number	BR-1	BR-2	BR-3	BR-4	BR-5	BR-6	BR-7	BR-8
Laboratory Sample Number	16262-009	16262-010	16262-011	16262-012	16262-013	16262-014	16262-015	16262-016
(Units in ug/l)								
TICs								
1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	11 JB/13 U	9.2 JB/13 U	3.3 JB/13 U	0.69 BJ/13 U	37 JB/13 U	6.0 JB/13 U	0.080 JB/13 U	210 J
tert-butylmethylether	ND	0.85 J	0.41 J	0.25 J	0.47 J	0.50 J	1.2 J	ND
VOCs								
1,1,1-Trichloroethane	0.50 U	0.36 J	1.6	0.23 J	2.5	0.12 J	0.98	2.5 J
1,1,2-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,1-Dichloroethane	0.50 U	0.18 J	2.2	0.30 JB	2.7	0.50 U	0.55	25 U
1,1-Dichloroethene	0.50 U	0.33 J	2.6	0.16 J	1.3	0.080 J	0.50 U	25 U
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,2-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,2-Dichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	2.2	0.50 U	0.52	25 U
cis-1,2-Dichloroethene	0.50 U	94 D	540 D	8.3	270 D	0.56	12	610 D
trans-1,2-Dichloroethene	0.50 U	0.50 U	0.53	0.50 U	0.40 J	0.50 U	0.50 U	25 U
1,3-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
1,4-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Benzene	0.50 U	0.080 J	0.17 J	0.50 U	0.12 J	0.50 U	0.50 U	25 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Chloroethane	0.50 U	0.50 U	0.31 J	0.50 U	0.32 J	0.50 U	0.50 U	25 U
Chloroform	0.50 U	0.080 JB/0.16 U	0.25 JB/0.16 U	0.070 JB/0.16 U	0.14 JB/0.16 U	0.50 U/0.16 U	0.060 JB/0.16 U	25 U
Chloromethane	0.50 U	1	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.84 B	0.50 U	0.29 JB	0.50 U	0.34 J	25 U
Ethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Methylene Chloride	0.19 JB/0.3 U	0.53 B/0.3 U	0.24 BJ/0.3 U	0.15 JB/0.3 U	1.1 JB/0.3 U	0.50 U	0.34 JB/0.3 U	14 JB
Naphthalene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Tetrachloroethene	0.50 U	0.50 U	0.12 J	0.50 U	0.50 U	8.4	1.9	25 U
Toluene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U
Trichloroethene	0.30 J	490 D	1,400 D	78 D	970 D	3.2	84 D	1,400 D
Trichlorofluoromethane	0.91 B	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	7.5 JB
Vinyl Chloride	0.50 U	0.50 U	0.89	0.50 U	0.42 J	0.50 U	0.50 U	25 U
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	25 U

Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	11/4/91						
Dames & Moore Sample Number	FB	OB-2	OB-4	OB-5	OB-6	OB-7	OB-8
Laboratory Sample Number	17394-009	17394-002	17394-006	17394-007	17394-013	17394-0016	17394-0012
(Units in ug/l)							
TICs							
1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	2.0 J	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
tert-butylmethylether	ND	ND	ND	ND	ND	ND	ND
VOCs							
1,1,1-Trichloroethane	0.50 U	7.3 D	0.50 U	2.3	0.50 U	0.50 U	2.1
1,1,2-Trichloroethane	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethane	0.50 U	16 D	0.50 U	3.2	0.50 U	0.50 U	3.5
1,1-Dichloroethene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,3-Trichlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2,4-Trimethylbenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	0.50 U	5 U	0.50 U	2.6	0.50 U	0.50 U	4.3
cis-1,2-Dichloroethene	0.50 U	160 D	0.50 U	30 D	0.50 U	0.50 U	49 D
trans-1,2-Dichloroethene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dichlorodifluoromethane	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Naphthalene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.50 U	5 U	0.50 U	0.50 U	17	1.9	0.50 U
Toluene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	0.50 U	170 D	0.50 U	48 D	2.5	2	110 D
Trichlorofluoromethane	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
m,p-Xylene	0.50 U	5 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U

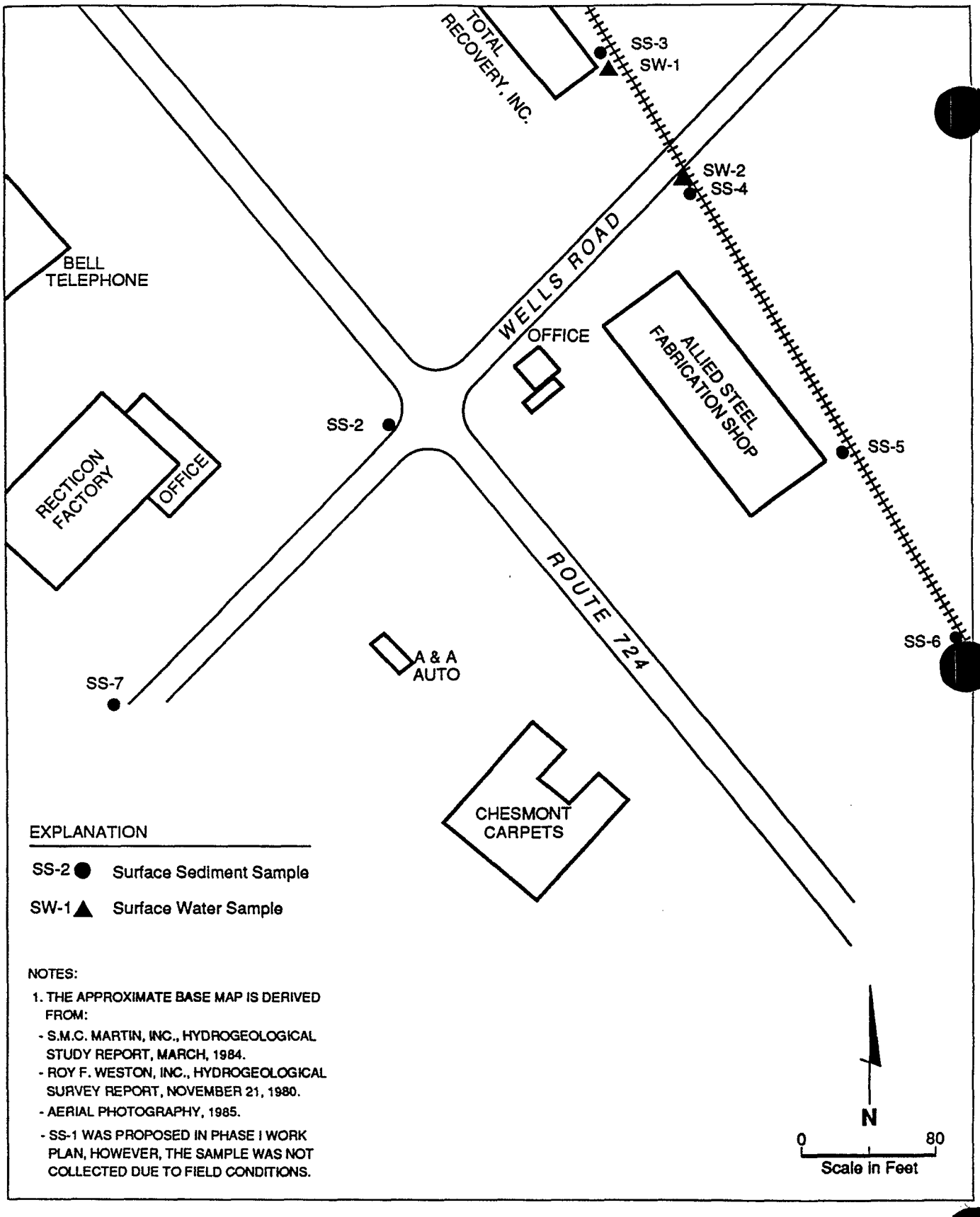
Table A-7
Analytical Results of Detected Chemicals in Groundwater during Four Sampling Periods

Sample Date	11/4/91 (Continued)							
Dames & Moore Sample Number	BR-1	BR-2	BR-3	BR-4	BR-5	BR-6	BR-7	BR-8
Laboratory Sample Number	17394-001	17394-003	17394-004	17394-005	17394-008	17394-014	17394-015	17394-011
(Units in ug/l)								
TICs								
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ND	3 J	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	560 J
tert-butylmethylether	ND	ND	ND	ND	ND	ND	1.5 J	ND
VOCs								
1,1,1-Trichloroethane	0.50 U	0.67	1.5	0.50 U	2.5	0.50 U	0.99	50 U
1,1,2-Trichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,1-Dichloroethane	0.50 U	0.92	2.2	0.50 U	2.5	0.50 U	0.50 U	50 U
1,1-Dichloroethene	0.50 U	0.50 U	2.4	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,2,4-Trimethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,2-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,2-Dichloroethane	0.50 U	0.50 U	0.50 U	0.50 U	2.6	0.50 U	0.50 U	50 U
cis-1,2-Dichloroethene	0.50 U	88 D	580 D	14	170 D	0.50 U	10	530 D
trans-1,2-Dichloroethene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,3-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
1,4-Dichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Benzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Carbon Tetrachloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.93	0.50 U	50 U
Chlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Chloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Chloroform	0.69	0.50 U	0.50 U	0.50 U	0.50 U	1.3	0.50 U	50 U
Chloromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Dichlorodifluoromethane	0.50 U	0.50 U	0.84 B	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Ethylbenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Methylene Chloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Naphthalene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Tetrachloroethene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	8.8	2.7	50 U
Toluene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Trichloroethene	0.50 U	400 D	1,400 D	120 D	780 D	3.4	83 D	1,200 D
Trichlorofluoromethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U
Vinyl Chloride	0.50 U	0.50 U	0.50 U	0.50 U	0.50 J	0.50 U	0.50 U	50 U
m,p-Xylene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	50 U

Detected concentrations were compared to detections in blank samples, and were considered as nondetects if appropriate.
e.g., 3 BJ/2 U denotes a sample detected originally at 3 which was changed to a nondetect based on the blank detection of 2.

J - Quantitation is approximate due to limitations identified during the quality control review.
B - This result is qualitatively suspect because it was detected in a field and/or laboratory blank at a similar level.
R - Unreliable result - analyte may or may not be present in this sample.
D - Dilution was required to bring sample into linear calibration range.
K - Biased high.
U - Compound was not detected.
L - Biased low.

ATTACHMENT B
SAMPLING LOCATIONS



SURFACE SOIL AND SURFACE WATER SAMPLING LOCATIONS

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/24/92 SURF-SOL

AR304139

FIGURE B-1